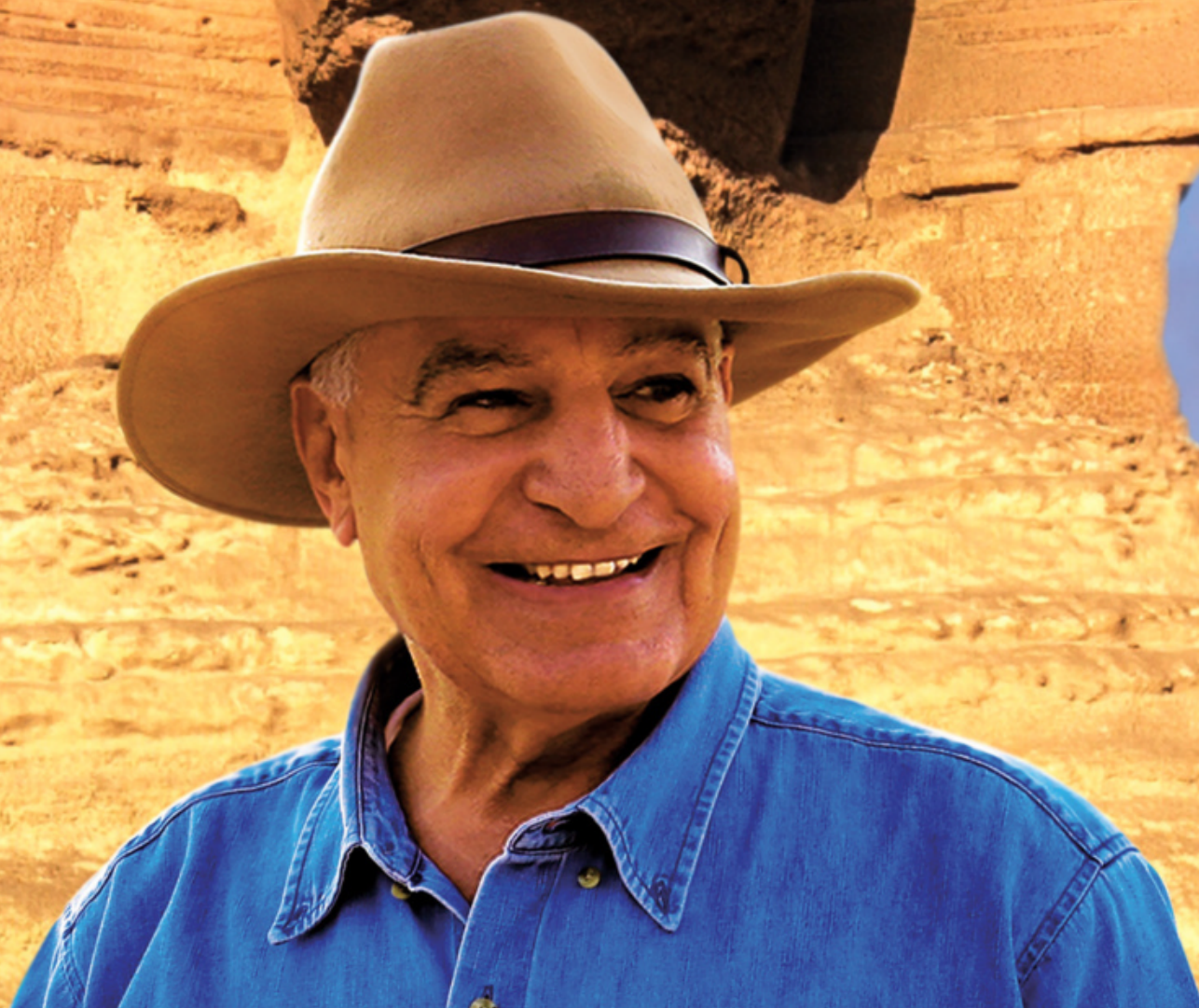


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January/February 2019

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CONTENTS



48 Laang Spean Cave, Battambang, Cambodia

FEATURES

26 TOP 10 DISCOVERIES OF 2018

ARCHAEOLOGY's editors reveal the year's most compelling finds

34 A DARK AGE BEACON

Long shrouded in Arthurian lore, an island off the coast of Cornwall may have been the remote stronghold of early British kings

BY JASON URBANUS

40 WHAT SANK *SAN DIEGO*?

Was it a German torpedo, a mine, or saboteurs that sent this imposing World War I ship to the bottom of the Atlantic?

BY JARRETT A. LOBELL

46 THE MAYA ANIMAL KINGDOM

Captive big cats might be key to understanding ancient Mesoamerica's complex network of culture and commerce

BY MARLEY BROWN

48 CAMBODIA'S CAVE OF BRIDGES

A vast mountainside cave in the midst of lush farmland conceals at least 70,000 years of Southeast Asian prehistory

BY KAREN COATES

Cover: Gilded silver mask discovered on the mummy of a priest buried at Saqqara, Egypt, dating to the Saite-Persian period (ca. 688–404 B.C.).

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DEPARTMENTS

4 EDITOR'S LETTER

6 FROM THE PRESIDENT

8 LETTERS

Adventures in corn smut consumption, the Modoc War's painful legacy, and pigment of the past

9 FROM THE TRENCHES

Secrets of Sumer, Amazonian artisanal chocolate, Egyptian sock couture, and Viking expats

24 WORLD ROUNDUP

Scottish clan memorabilia, a conquistador shrine, Neolithic nutmeg, Maya sea salt harvesters, and a Chinese model house

55 LETTER FROM LEIDEN

Exploring the unlikely history of sanitation management in medieval Holland

BY WILL HUNT

68 ARTIFACT

Heirloom apparent

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A WORLD OF SURPRISES

We often ask archaeologists whether they were surprised by anything they uncovered during their excavations. They usually say yes, not because they hadn't done everything possible to prepare before putting their trowels in the ground or their samples under the microscope, but because archaeology is about discovery, and thus often about the unexpected. Archaeologists are sometimes surprised because a site is so much larger or an artifact is so much older than they expected, or because no one has ever found anything quite like it before. We don't want to give them all away, but in the latest version of our always-popular annual feature, "Top 10 Discoveries," you'll read about many such finds, including the oldest recipe for a favorite food, instructions on how to make a mummy, and one very, very unusual artifact. We know you'll be surprised, too.



Even the seemingly best known sites can produce surprises, as contributing editor Jason Urbanus shows in "A Dark Age Beacon." At Tintagel Castle, where King Arthur's legendary story began, a team of archaeologists is working to uncover the truth that lies behind the myths of the king and his Knights of the Round Table. They are investigating an early period at the site when a line of Cornish kings ruled southwestern England. The newly uncovered remains of a large, post-Roman settlement there may surprise us by overturning the accepted vision of Britain's Dark Ages.

"Cambodia's Cave of Bridges," by contributing editor Karen Coates, tells the story of the discovery of more than 70,000 years of history in a remote cave in the Southeast Asian country's far western Battambang Province. To find evidence of so many millennia of human occupation was, for the French husband and wife team who first explored the cave in the 1960s, a complete surprise—no site that old had ever before been found in Cambodia.

Sometimes it's the places archaeologists look for evidence of people's lives that's surprising. Take, for example, "Letter from Leiden" by Will Hunt. Here the author follows Dutch archaeologist Roos van Oosten as she searches the cesspits and sewers of Leiden, Haarlem, and other urban centers across Europe, seeking out whether or not these medieval and early modern cities were in fact the foul-smelling, unhygienic towns of Victorian writers' imaginations.

And would it surprise you to learn that Maya kings kept jaguars and pumas in captivity? Or that there is a sunken World War I warship just off the coast of Long Island? Or that archaeologists are once again uncovering extraordinary new wall paintings in Pompeii?

A world of surprises awaits you in this issue!

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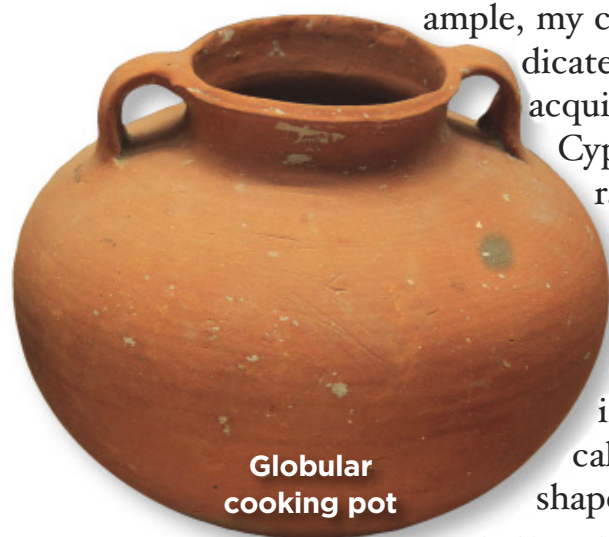
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FROM THE PRESIDENT

DID JESUS EAT QUICHE?

As a ceramics specialist, I have devoted my career to understanding what pottery tells us about the people who manufactured and used it. In the process, I have learned many interesting things. Potsherds are, by far, the most common find at excavations around the Mediterranean—they are recovered literally by the ton. Because pottery is so common, archaeologists rely on it to date what we dig up by tracking changes in vessel types and shapes over time.

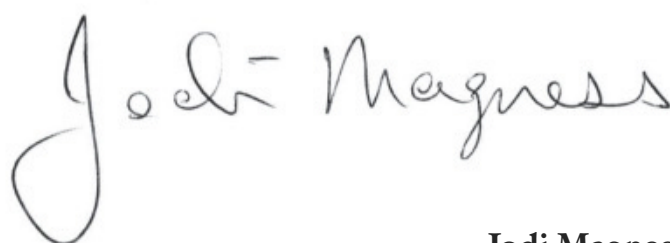
Pottery can also be a valuable source of information about ancient trade. For example, my current excavations at Huqoq in Israel's Galilee indicate that in the fifth and sixth centuries, villagers there acquired fine tableware imported from North Africa, Cyprus, and Asia Minor. In this same period, amphorae containing wine from Palestine were transported around the Mediterranean.



Globular
cooking pot

Pottery can also inform us about dining habits in antiquity. For example, for thousands of years, cooking pots in ancient Palestine were characterized by a globular body, narrow neck, and two vertical handles connecting the rim to the shoulder. This shape was designed to prepare liquid-based foods—the narrow neck and mouth minimize spillage and evaporation, while the round body allows the contents to be boiled for an extended time by distributing the heat evenly. The prevalence of this style of cooking pot indicates that the local diet consisted largely of vegetable- and lentil-based soups, gruels, and stews. These were inexpensive and easy to prepare by boiling any food on hand—think, for example, of the folk tale of stone soup. The cooking pots' mouths were too narrow for big chunks of meat, a rare and expensive commodity, although small pieces of chicken, which was more readily available, could have fit. In a world where food was often scarce, a family could stretch a meal by adding water to the mixture. Prolonged boiling yielded a soft mush that did not need to be chewed—a necessity because many adults did not have a full set of teeth due to lack of dental care. Diners used soft, flat bread baked in household ovens to sop up the mush.

In the early first century, Galilean potters began to manufacture shallow pans of a type they adopted from the Romans. These pans quickly became ubiquitous and attest to the introduction of a new, Italian-style cuisine that included baked or fried eggs mixed with chopped fruit, vegetables, fish, or meat. Once introduced, the shallow pans remained part of the local ceramic repertoire alongside the traditional globular cooking pots for hundreds of years. Thus, pottery shows that the typical Galilean diet in Jesus' lifetime consisted of both native boiled mush served with bread and Roman-style quiches and frittatas.



Jodi Magness

President, Archaeological Institute of America

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LETTERS

FROM OUR READERS

We received many letters about “Eat More Spore” in our November/December 2018 issue. We salute our adventurous readers—and those who wish to be—who shared their experiences with us.

A TRUE DELICACY

I was delighted to read the short article “Eat More Spore.” People still eat this delicious fungus that is called *huitlacoche* in Mexico. I first had the opportunity to try this on my family’s first trip to Mexico many years ago. The *huitlacoche* was served in a crepe with corn. It was as black as ink and had a wonderful, earthy flavor. It’s too bad that more Americans do not know more about this edible fungus.

Scott Bumbaugh
Huntsville, TX

It might interest readers to know that corn smut was part of the diet of Native Americans in the Southwest, and was also included in the cuisine of the Aztecs.

Kim Frasse
Sacramento, CA

ARCHAEOLOGY welcomes mail from readers. Please address your comments to ARCHAEOLOGY, 36-36 33rd Street, Long Island City, NY 11106, fax 718-472-3051, or e-mail letters@archaeology.org. The editors reserve the right to edit submitted material. Volume precludes our acknowledging individual letters.

While detasseling corn back at Clyde Black & Sons popcorn farm outside Ames, Iowa, in the 1960s, we always encountered corn smut. To us young teens doing the work, it was disgusting. I wish I’d known then what I know now about this fungus. Thanks for educating!

Marilyn B. Saul
Tucson, AZ

When I was a teenager and detasseled corn in Mendota, Illinois, we were instructed to knock down stalks with ears that had smut! Imagine my surprise as an adult to see it on the menu of a very nice restaurant in Mexico. I took a pass, and the memory of it was repulsive. I now wish I had tried it.

Denise Shirey
Southlake, TX

DIFFICULT JOURNEYS

I was absolutely humbled by Julian Smith’s article “Inside a Native Stronghold” (November/December 2018). The author’s account of the tragic and brutal story of the Modoc War as revisited by an archaeological team was powerful. But I was moved by Ms. James’ and Mr. Saluskin’s perspectives. Archaeology can be a passionate science or an interesting hobby, but it can also sometimes be a painful intrusion into people’s lives. Ms. James and Mr. Saluskin were witness to that.

Bert Atkinson
Los Angeles, CA

TOXIC COLOR

In World Roundup (November/December 2018) you refer to the analysis of the clothing of two Inca females sacrificed at the site of Cerro Esmeralda that detected cinnabar pigment, a mineral not native to northern Chile, and one that was potentially toxic. In collaboration with geochemists, I have been studying cinnabar in the central Andes. During the prehistoric period, most cinnabar was mined in the Huancavelica Mercury Mining Zone, a massive deposit in the highlands of south-central Peru. There is at least one more source yet to be located that was also exploited. Cinnabar was widely used as a pigment for face and body painting, and a study I did in collaboration with eminent pathologist Jerrold Leikin found that the toxicity of cinnabar is actually low, even when inhaled. As an inorganic form of mercury, it is much less toxic than organic and elemental forms of mercury—such as the metallic mercury once used in thermometers and children’s games. It’s probable that cinnabar was not considered toxic in pre-Hispanic times, and it is still commonly used in traditional Chinese medicine.

Richard L. Burger
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THE CASE OF THE STOLEN SUMERIAN ANTIQUITIES

On May 2, 2003, shortly after the invasion of Iraq, London's Metropolitan Police raided an antiquities dealer and seized eight artifacts they believed had been obtained through illicit channels. It's typically impossible to trace looted antiquities back to their original context. But in this instance, through a combination of good fortune and canny sleuthing, experts were able to close the case.

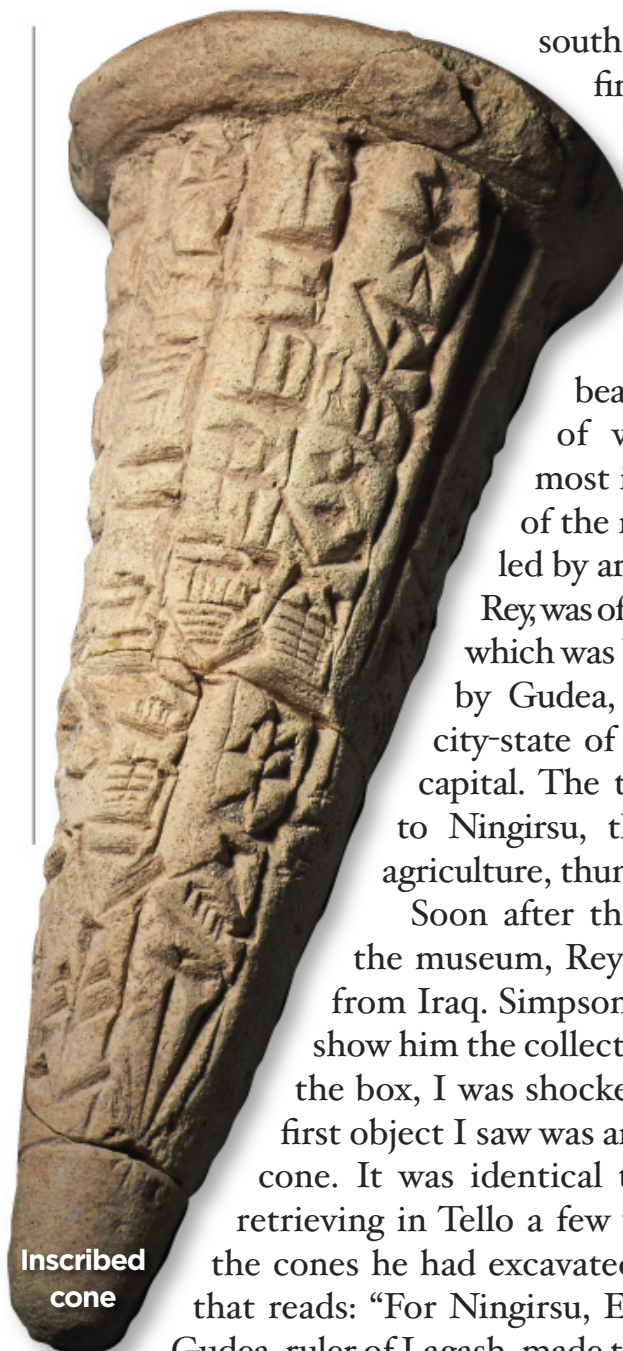
The artifacts—three ceramic cones bearing cuneiform inscriptions, one marble and one chalcedony stamp seal, a gypsum mace-head, a marble amulet pendant, and an inscribed river pebble—remained in police possession until late 2017, when they were brought to the British Museum and examined by St. John Simpson, a curator in the Middle East department. They appeared to him to have come from ancient Mesopotamia, and to have been produced by various cultures between the fourth and first millennia B.C. “It was clear they were from a big, important, multi-period site,” Simpson says. “That meant we had a short list of a very small number of places in southern Iraq.”

By an extraordinary stroke of luck, the previous year the museum had launched an excavation at just such a site: the ancient Sumerian city of Girsu, in modern-day Tello, in

southern Iraq. Girsu was first excavated in the late nineteenth century and is among the world's oldest known urban centers. Many inscribed artifacts from the site bear evidence of the birth of writing. Among the most important discoveries of the new excavation there, led by archaeologist Sebastien Rey, was of a temple called Eninnu, which was built around 2100 B.C. by Gudea, king of Lagash, the city-state of which Girsu was the capital. The temple was dedicated to Ningirsu, the Sumerian god of agriculture, thunder, and storms.

Soon after the artifacts arrived at the museum, Rey returned to London from Iraq. Simpson could hardly wait to show him the collection. “When I opened the box, I was shocked,” Rey recalls. “The first object I saw was an inscribed terracotta cone. It was identical to cones I had been retrieving in Tello a few weeks earlier.” All of the cones he had excavated bore an inscription that reads: “For Ningirsu, Enlil's mighty warrior, Gudea, ruler of Lagash, made things function as they should (and) he built and restored for him his Eninnu, the White Thunderbird.” Says Rey, “One purpose of these objects was to say for eternity that this king had built a temple for his god.”

The London cones had the exact same inscription as those Rey had just discovered embedded in the temple's mudbrick walls, with the text pointing up toward the sky so the god himself could read them. He was thus able to identify them as having come not just



Inscribed cone

Chalcedony stamp seal



Marble stamp seal



Gypsum mace-head



Marble amulet

FROM THE TRENCHES



from Girsu, but from the very temple wall his team had been excavating.

And as for the five other items seized from the dealer? Rey says these,

too, were clearly from Tello. They are similar to other artifacts found at the site, though the amulet pendant and the marble stamp seal are older than the cones, and the chalcedony stamp seal is younger.

Close to the temple, Rey and his team identified looters' pits containing broken pieces of the very same type of inscribed ceramic cones, which had been left behind by the thieves. Rey learned from local tribal authorities that the looting

had taken place just after the 2003 invasion. "All the objects went from the crime scene onto the black market within a very, very short period of time," says Simpson. "Within about a month, they had been dug up, put in someone's pocket, and transported to central London. It's very rare that we can document that so accurately and establish that timeline so precisely." With the items' provenance convincingly established, they were returned to Iraq in August 2018 and will be housed in the country's national museum.

—DANIEL WEISS

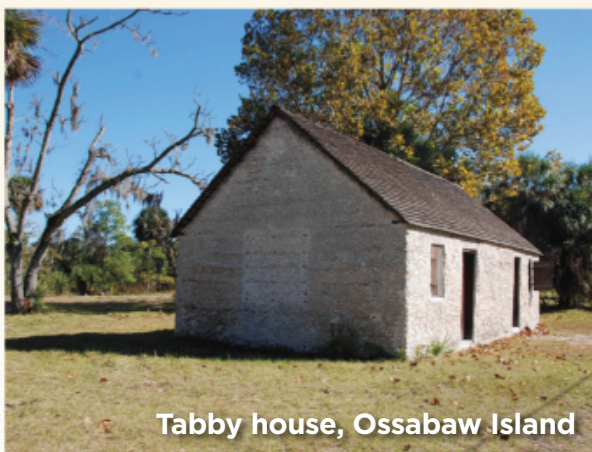
OFF THE GRID

OSSABAW ISLAND, GEORGIA

Draped in Spanish moss and overrun by the wild descendants of hogs introduced in the sixteenth century, Georgia's Ossabaw Island is both a time capsule and rural oasis. Just 20 miles south of Savannah by water, Ossabaw spans 26,000 acres. Among its hundreds of archaeological features, representing at least 4,000 years of human habitation, are shell rings and burial mounds left by the earliest inhabitants, remains of precontact Native American villages, and eighteenth-century indigo plantations. According to archaeologist Victor Thompson of the University of Georgia, Ossabaw may have been abandoned at some time before the Spanish arrived on the Georgia coast in the 1540s. Archaeologists hope to determine when and why the island's indigenous people, the Guale, left. Ossabaw was in private hands until 1978, when its owner, the now 105-year-old Eleanor Torrey West, sold it to the state, with the stipulation that it be protected as a cultural and environmental preserve. Ossabaw is only accessible by boat, and visitation is limited. Fortunately for history buffs and nature lovers, the nonprofit Ossabaw Island Foundation offers tours and overnight stays and hosts public events throughout the year. The foundation has also restored several buildings belonging to the island's North End Plantation, including three mid-nineteenth century tabby cabins that were originally houses for enslaved people. They are named for their unique construction style, which uses a type of concrete made of oyster shells, lime, and sand. The cabins, says foundation director Elizabeth DuBose, are important monuments to Ossabaw's heritage. Well into the twentieth century, the buildings were occupied by descendants of slaves. Their West African cultural traditions, now known as Gullah Geechee, continue to thrive across the Georgia and South Carolina Lowcountry.

THE SITE

Arrange a day or overnight trip and take a safari along the oak-lined dirt road that bisects the island. Keep an eye out for white-tailed deer, armadillos, shorebirds, and alligators. While its interior is not open



to the public, you can still catch a glimpse of the 1920s Spanish-style mansion where the Torrey family hosted Rockefellers and Carnegies during the Jazz Age. In addition to touring the restored tabby cabins and prehistoric sites nearby, visitors can also take

part in a public participation day during the University of Georgia's annual summer field school. You might find yourself searching for a new site using ground-penetrating radar or excavating a Late Archaic midden.

WHILE YOU'RE THERE

You can't go wrong strolling around nearby Savannah, which has one of the largest historic districts in the United States. The city is home to world-class museums and a vibrant culinary scene. Visit the 1819 Owens-Thomas House with its restored gardens and slave quarters, a monument both to Savannah's antebellum elegance and the brutal system upon which it relied.

—MARLEY BROWN

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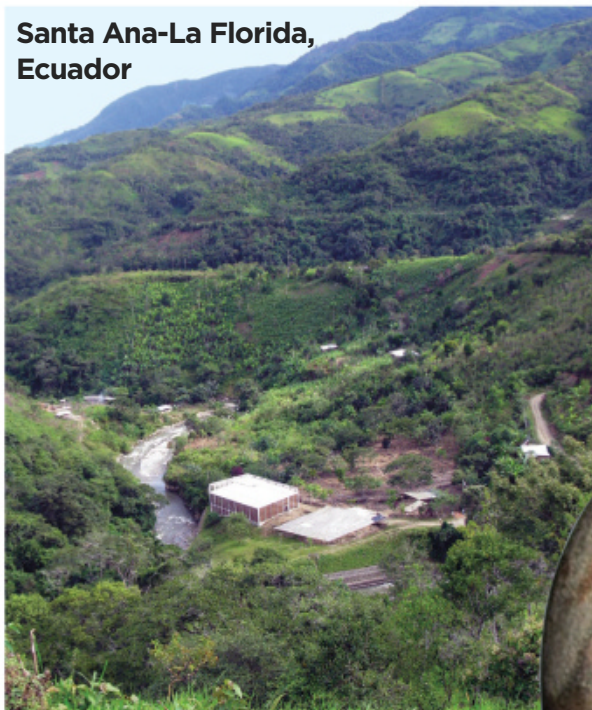
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FROM THE TRENCHES

ANCIENT AMAZONIAN CHOCOLATIERS

Cacao seeds, the raw material used to make chocolate, were being consumed in southeastern Ecuador much earlier than archaeologists have thought. The evidence comes from chemical analysis of bottles found at an ancient village now called Santa Ana-La Florida. “We were surprised at how clear the evidence of cacao use is 5,300 years ago and that it continues throughout the 3,000-year history of the site,” says archaeologist

**Santa Ana-La Florida,
Ecuador**



Michael Blake of the University of British Columbia.

Ancient Ecuadorean cacao was, in all likelihood, not made into candy bars or anything else resembling modern chocolate. The people at Santa Ana-La Florida probably fermented the seeds and then dried and ground them to make a beverage. Modern indigenous people in Ecuador use cacao as a medicine and a stimulant, as well as an ingredient in food and drink. Domesticated cacao, researchers suggest, was traded from South American to Mesoamerican cultures, such as the Maya and Aztecs, starting at least 3,900 years ago.

—ZACH ZORICH

**Hearth and tomb,
Santa Ana-La Florida**



**Bottles with
chocolate
residue, Santa
Ana-La Florida**





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STONE COLD FOX

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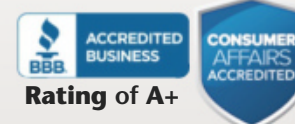
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FROM THE TRENCHES

FIT FOR A PRINCE



Between the ninth and the third centuries B.C., a people known as the Picenes moved from Latium in central Italy to the area covering today's Marche and northern Abruzzo regions. Much of what is known about the Picenes, one of pre-Roman Italy's most important cultures, comes from a number of burials discovered over the last few decades. Recently, archaeologists from the University of Bologna unearthed a large Picene



tomb dating to the seventh century B.C. in the village of Corinaldo, near the Adriatic Coast. The burial, which team leader Federica Boschi has dubbed the "Tomb of the Picenian Prince," was originally covered by a mound. It is nearly 130 feet square and was surrounded by a moat. Before this discovery, says Boschi, "no other Picenian tombs had been discovered in this region, which was a strategic location for cultural exchange between different pre-Roman populations," as evidenced by vessels found in the burial that had been imported from Etruria, home of the Etruscans. The grave's other contents, including a bronze helmet and weapons, bronze vessels, and a war chariot with iron wheels are, says Boschi, further evidence of the deceased's aristocratic status.

—MARCO MEROLA



Cheese sieve, Croatia

Milk vessel, Croatia

WHEN THINGS GOT CHEESY

Some of the earliest evidence of cheese making has been identified on pottery found on the Dalmatian coast of Croatia. A multinational team of archaeologists and chemists analyzed fatty-acid residues dating to the Middle Neolithic period, about 7,200 years ago. Evidence of cheese making dating to roughly the same period has also been found in Poland.

At that time, milk production was already an established practice, but fermenting raw milk into cheese may have provided an additional survival advantage. Children who have been weaned from their mother's milk are particularly vulnerable to malnutrition. As they age, they gradually lose the ability to digest the milk sugar lactose. Fermenting milk into cheese reduces its lactose content, while still providing a rich source of calories. The team also found that specific pottery shapes were associated with cheese production, including sieves and a type of footed pot with an opening on its side.

—ZACH ZORICH

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FROM THE TRENCHES

FUNNY BUSINESS

A public latrine used by ancient patrons of a large bathhouse and government officials who worked nearby is the setting for a recently discovered, somewhat

bawdy mosaic. A team from the University of Nebraska had been excavating the site of the city of Antiochia ad Cragum on the south coast of Turkey for more than a decade when they uncovered the second-century A.D. mosaic, which features humorous takes on famous Greek myths. One panel portrays Narcissus, the boy who fell in love with his own reflected image. Here he is infatuated with a rather more intimate part of his anatomy. Another panel shows Ganymede, cupbearer to the gods, offering up the ancient version of toilet paper.

Project leader Michael Hoff explains that Romans weren't squeamish about depicting bodily functions and sexuality. "One only has to visit the houses of Pompeii to see that images of sex and nudity were commonplace and visible to all, regardless of gender or status in society," he says. Hoff adds that while the majority of Antiochia ad Cragum's residents were not of Greek or Latin heritage, the mosaic demon-

strates that Greek myths were almost universally understood in the far-reaching Mediterranean world.

—MARLEY BROWN



Mosaic at Antiochia ad Cragum, featuring Narcissus (left) and Ganymede (right)

DOUBLE VISION



Terracotta sarcophagus, Pallavaram, India

A team of archaeologists in southern India has unearthed an approximately 2,300-year-old terracotta sarcophagus in Pallavaram, located 15 miles from the city of Chennai. "The nearly intact, handmade, oblong coffin is an important discovery," says A.M.V. Subramanyam, superintending archaeologist of the Archaeological Survey of India (ASI) in Chennai. An almost identical sarcophagus was found 130 years ago in the same area. The 1888 find was the first artifact to establish the existence of a distinctive Iron Age culture in this region. Researchers from the ASI will soon perform thermoluminescence dating to determine the sarcophagus' exact age.

—GURVINDER SINGH

RAISE A TOAST TO THE AUROCHS



The last aurochs, the wild ancestor of domesticated cattle and a favorite game animal up to the medieval period in Europe, died at a game preserve in Poland in 1627. Now a group of Scandinavian researchers are searching for the long-lost bovine's genetic signature in medieval drinking horns. For the better part of the Middle Ages, well-heeled noblemen preferred to quaff their beverages from the horns of bulls—and the bigger the horn the better. In fact, this may have been a contributing factor to the aurochs' extinction.

The researchers examined mitochondrial DNA that they had recovered from five medieval drinking horns. Mitochondrial DNA (mtDNA) is inherited from the mother's side. They also looked at the horn of the last bull aurochs.

Three of the drinking horns contained aurochs mtDNA, but two drinking horns and the horn of the last bull aurochs showed mtDNA from domestic cattle as well. This may be evidence of interbreeding between the two species.

Future work will focus on recovering the rest of the aurochs genome.

—ZACH ZORICH

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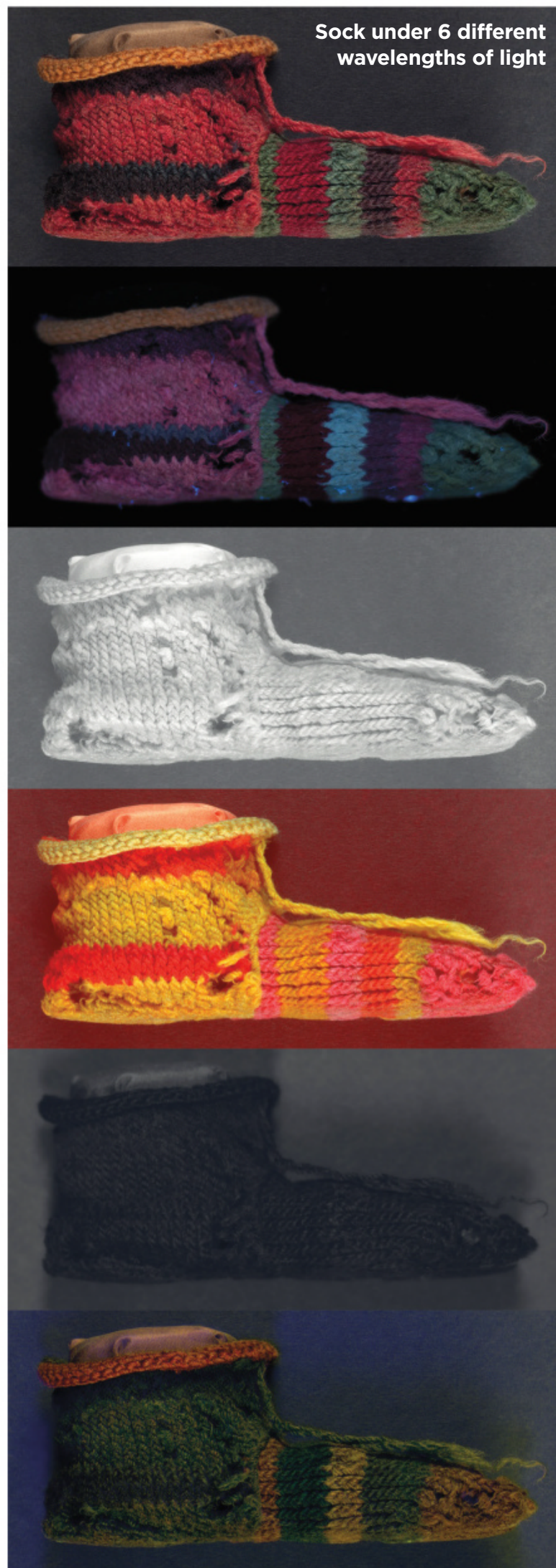
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FROM THE TRENCHES

A LOST SOCK'S SECRETS

Still vibrant after 1,700 years, a child's striped left sock is providing evidence of just how subtly dyers plied their craft in Roman-era Egypt. Unearthed in 1913 in a trash heap at the site of Antinopolis, a city founded by the emperor Hadrian, the woolen sock is one of four ancient Egyptian textiles recently studied by a team led by British Museum chemist Joanne Dyer. She and her colleagues examined the artifacts, which also included fragments of decorated wool tapestries, with an array of imaging techniques that exposed the textiles to different wavelengths of light. These techniques have previously been used to analyze painted surfaces. The different light sources allowed the team to determine the chemistry of the dyes used to color the textiles without having to remove samples that might damage the artifacts. They found that just three natural colorants—indigo, the herb madder, and the weld plant—created the sock's exuberant stripes. "What's surprising is that while the textiles are highly colored and very varied, the ancient Egyptians used only a few natural dyes to create this extensive palette," says Dyer. Despite scant resources, a skillful dyer was able to make a stripy sock that wouldn't look out of place on a playground today.

—ERIC A. POWELL



LAND OF THE ICE AND SNOW

The Vikings are renowned for having traveled great distances from their homeland in Scandinavia. A new study suggests that many residents of Sigtuna, a major Viking town in eastern Sweden, were themselves immigrants from afar. Researchers from Stockholm University sequenced the genomes and analyzed strontium isotopes from the remains of 16 people buried in Sigtuna between the tenth and twelfth centuries. Isotope analysis showed that eight of the 16 individuals had grown up in or near the town, and eight had grown



up elsewhere. Of those who moved to the town, four had genetic features suggesting they had come from other parts of Scandinavia, while four appeared to have arrived from farther away, most likely Eastern Europe. Two of those who had grown up locally had unusual genetic profiles for the area, suggesting that they were second-generation immigrants. "We knew that Sigtuna had a lot of contact with other regions," says researcher Maja Krzewinska, "but we didn't know to what degree and we didn't know whether the foreigners actually lived and stayed in Sigtuna. Now we can prove it."

—DANIEL WEISS

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FROM THE TRENCHES

Bath Abbey, Bath, England



BATH TILES

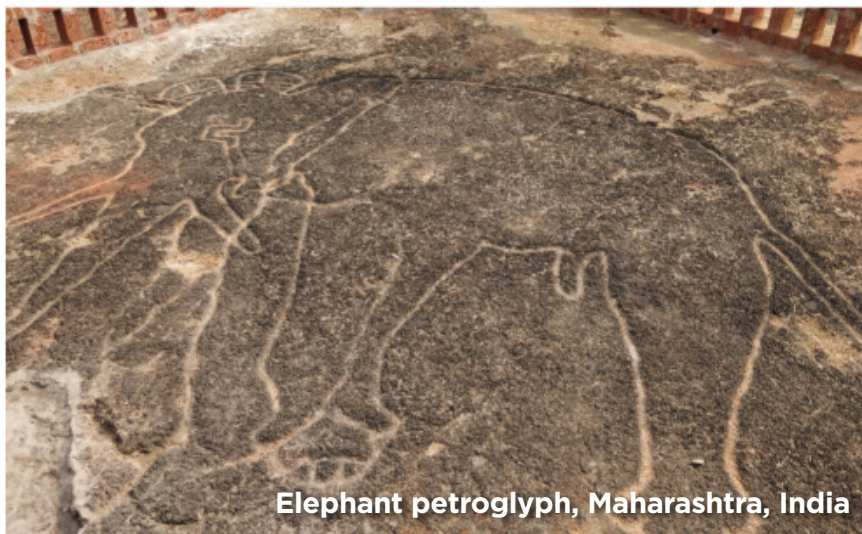
Brightly colored tiles have been uncovered during excavations in advance of restoration of England's Bath Abbey. The site has been home to religious buildings for more than 1,000 years. The current church, which was completed in the seventeenth century, was constructed above the remains of a Norman-era cathedral that had fallen into disrepair by the late 1400s. The tiles once formed a portion of that cathedral's

floor. "In situ medieval tile floors like this are incredibly rare," explains project director Cai Mason of Wessex Archaeology. "The only reason this one survived is that the Norman cathedral was knocked down and essentially buried during construction of the current building, saving the original flooring." The tiles have now been covered by a protective layer before new floors are installed.

—MARLEY BROWN

INDIA'S ANONYMOUS ARTISTS

In the coastal Konkan region of India's western state of Maharashtra, around 1,000 petroglyphs have been discovered spread out over dozens of different sites. Nearly all of them are found on hilltops. In a few cases, local people were aware of the designs, but most were previously unknown—and many were hidden beneath a layer of earth. The carvings depict a wide range of subjects, including elephants, monkeys, peacocks, sharks, and alligators, as well as human figures and geometric patterns. According to Tejas Garge, director of the Maharashtra state archaeology department, the drawings were probably created between 12,000 and 5,000 years



Elephant petroglyph, Maharashtra, India



Geometric petroglyph

ago. Little is known of their creators, however, as no associated settlement sites have been found. Given that the carvings don't depict domesticated

animals and agricultural activities, says Garge, the people who made them were likely hunter-gatherers.

—DANIEL WEISS

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FROM THE TRENCHES



Gold coins, Como, Italy

NO RAINBOW REQUIRED



Soapstone vessel

On the site of Como's former Cressoni Theater, once one of northern Italy's great opera houses, excavators have found a soapstone vessel filled with hundreds of Late Antique gold coins. The location, now slated for luxury apartments, is close to the forum of Novum Comum, a settlement founded by Julius Caesar in 59 B.C. Thus far, conservators have removed several dozen coins from the vessel and identified five emperors' portraits, all dating to the fourth and fifth centuries A.D., depicted on the coins.

—JARRETT A. LOBELL

PASSAGE TO THE AFTERLIFE

A monument that may lead to a shift in scholars' vision of Ireland's prehistoric past has been discovered in the Boyne Valley north of Dublin. The 5,500-year-old passage tomb—a complex of multiple burials—is thought to be one of the oldest ever discovered in the area, which is renowned for its concentration of Neolithic sites. One of the stones that once covered the tomb is especially well carved. The tomb's relatively small size suggests that it was constructed earlier than other tombs in the valley, says archaeologist Stephen Davis of University College Dublin. It may date closer to when people first began farming in the region, around 3800 B.C. "The tomb seems to mark a transition towards a time when religion played a greater role in people's lives," he says. To some extent, suggests Davis, the free time to build such monuments must have been the result of an agricultural surplus.

—MARLEY BROWN



Carved stone, Boyne Valley, Ireland

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CONNECTICUT: Renovations to a modern railroad bridge near Norwalk uncovered 17th-century artifacts and traces of a rare Native American fort dating to the early period of European contact. The objects, both native and European, suggest the site may have been a prominent trading post where the native population exchanged goods with Dutch settlers. Historians hope the excavations will provide important cultural information about the little-known Norwalk Indians.



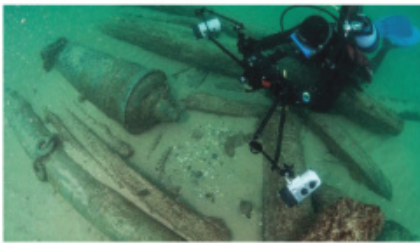
SCOTLAND: The personal seal of John Campbell of Cawdor, a prominent participant in Scotland's notorious MacDonald-Campbell clan conflicts, was found beneath a layer of rubble at Dunyvaig Castle on the island of Islay. Once the stronghold of the MacDonald Lords of the Isles, Dunyvaig was fought over by the rival clans. It fell to Campbell in 1615. The lead seal, which was used to sign documents, is inscribed with Campbell's name, the date 1593, and the Cawdor coat of arms featuring a galley ship and a stag.



FLORIDA: A long-lost shrine dedicated to Nuestra Señora de La Leche y Buen Parto at the Mission Nombre de Dios in St. Augustine may finally have been located. The important religious structure was built by Governor de Hita y Salazar in 1677 and damaged by a British attack in 1702. It was eventually rebuilt nearby. During the 1950s, a local priest who was also an amateur archaeologist rediscovered the original building's foundations, but they were quickly reburied and the location was forgotten for decades.



BELIZE: Maya communities living in coastal Belize more than 1,000 years ago manufactured large quantities of sea salt that they traded to inland settlements. A recent evaluation of wear patterns on stone tools from the Paynes Creek Salt Works indicates that the Maya may have produced and traded salted fish and meat as well. Researchers originally thought the tools were used for cutting wood, but striations on the blades are more consistent with cutting fish, chopping bones, and scraping animal hides.



PORTUGAL: The wreck of a 400-year-old Portuguese ship dating to the golden age of the European spice trade was located near the mouth of the Tagus River, 15 miles west of Lisbon. The ship appears to have sunk after returning from India with its cargo of valuable spices and Asian artifacts. During a preliminary survey of the wreck site, divers documented peppercorns, 9 bronze cannons engraved with the Portuguese coat of arms, Chinese porcelain from the Wanli period (1573-1620), and cowrie shells, which were often used as currency.



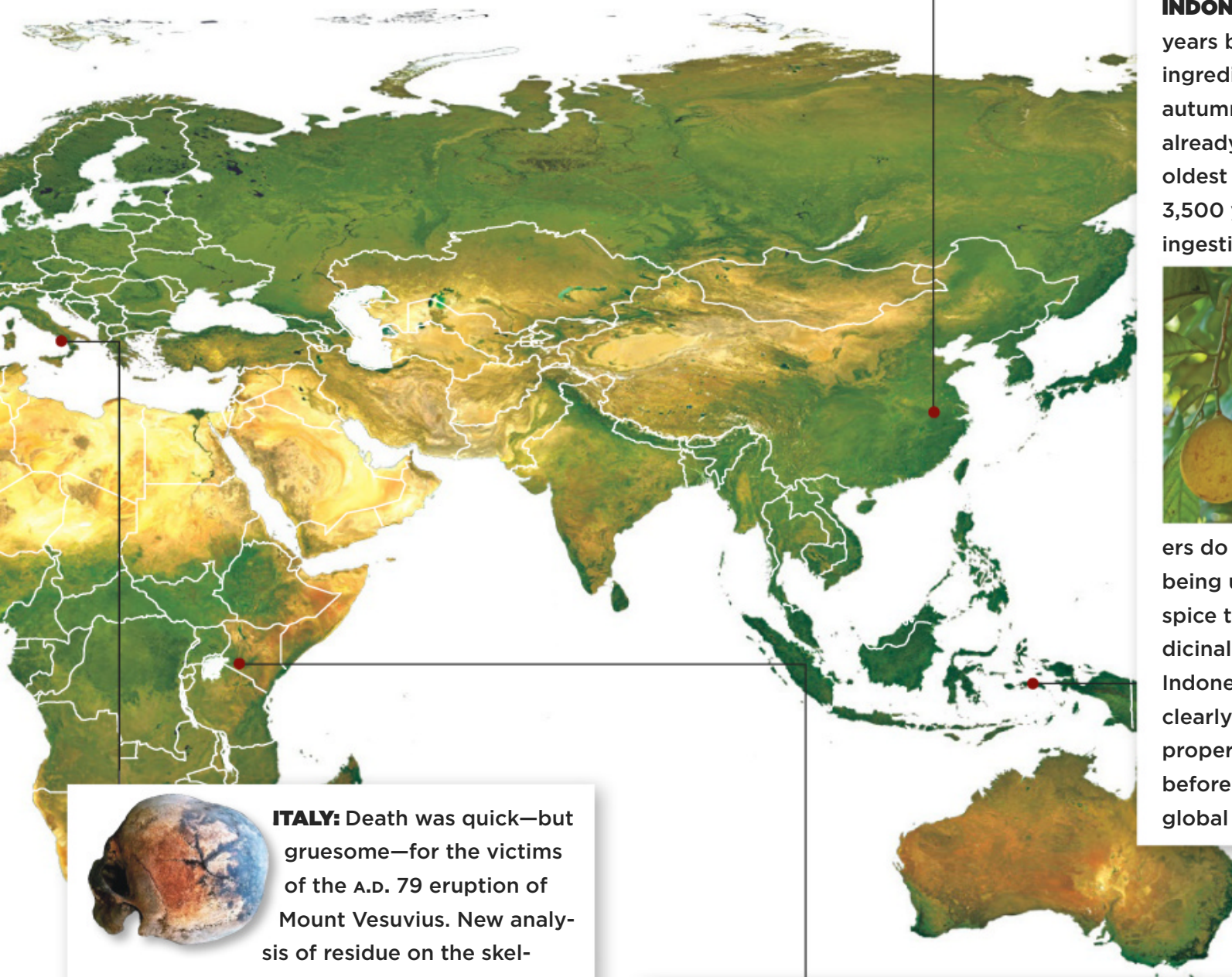
FRANCE: A 2nd-century Roman water mill in Barbegal was one of the world's first industrial complexes, capable of producing 28 tons of flour per day. Scholars believed that the mill supplied grain to the nearby

city of Arles. But a recent examination of carbonate mineral deposits revealed that it was regularly closed for months at a time. Instead of feeding the population of Arles, the mill likely manufactured hardtack, a nonperishable foodstuff essential for ship crews during sailing season.



CHINA: A 900-year-old tomb of a Chinese woman near Tieguai Village, Anhui Province, contained a fabric banner identifying her as the "Grand

Lady." Judging from her luxurious burial, she certainly merited the moniker. Her well-preserved body still bore gold and silver hairpins, silver bracelets, gold earrings, fancy robes, and embroidered shoes, and her grave was filled with more than 200 other objects. These include bundles of clothing, cosmetic tools, wooden figurines, bronze coins, porcelain bowls, and even a model courtyard house, complete with tiny furniture.

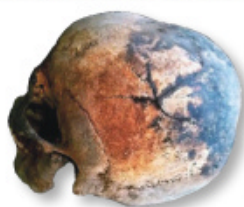


INDONESIA: Thousands of years before it became a trendy ingredient in pumpkin-flavored autumn treats, nutmeg was already spicing things up. The oldest evidence—from some 3,500 years ago—for humans ingesting nutmeg has been



detected on pottery sherds from Pulau Ay in the Banda Islands. Research-

ers do not know whether it was being used for its fruit, as a spice to flavor food, or for medicinal purposes. But Neolithic Indonesian communities were clearly familiar with its unique properties and flavor long before it became a sought-after global commodity.



ITALY: Death was quick—but gruesome—for the victims of the A.D. 79 eruption of Mount Vesuvius. New analysis of residue on the skel-

etons of people trapped along the waterfront in the town of Herculaneum suggests that exposure to extreme heat may have been their cause of death, not asphyxiation, as has traditionally been thought. Herculaneum and other nearby towns were hit with a fast-moving cloud of ash and gas that reached temperatures of 900°F. This vaporized blood, bodily fluids, and brain matter, literally causing heads to explode.



KENYA: Africa's savannas, such as the Serengeti, are renowned for their biodiversity and pristine nature. A new study proposes that human intervention may have been instrumental in creating these ecosystems 3,000 years ago. Soil analysis from Neolithic sites associated with nomadic herders in southern Kenya

shows that dung from corralled livestock created nutrient-rich "hotspots" across the prehistoric landscape. This led to an increase in fertile grasses thousands of years ago that, even today, attract a diverse array of wildlife.



THE FIRST BAKERS

Shubayqa, Jordan

About 14,400 years ago in the Black Desert of northeastern Jordan, someone was tinkering with the recipe for the perfect pita. This auspicious moment in culinary history has been captured by researchers who sampled the contents of two stone fireplaces at the site of Shubayqa 1. The team, led by University of Copenhagen archaeobotanist Amaia Arranz-Otaegui, found that the people living at this small campsite, hunter-gatherers who belonged to a culture known as the

Natufians, were making unleavened bread-like products at least 4,000 years before the dawn of agriculture. Charred remains from the ovens suggest Natufians gathered wild cereals and tubers to make flour for the bread, which, at



ARCHAEOLOGY's editors reveal the year's most compelling finds

TOP 10 DISCOVERIES

the time, was probably not a staple food, but a rare treat reserved for special occasions. “We were very surprised to find bread made before the origins of agriculture,” says Arranz-Otaegui. “Archaeologists have tended to ignore food remains that we don’t recognize, and I’m sure the remains of bread-like products even more ancient than these are everywhere.”

Meanwhile, a Stanford University team

analyzed residues on three Natufian stone mortars unearthed roughly 150 miles east of Shubayqa 1, in Israel’s Raqefet Cave. They detected evidence that Natufians were brewing beer from wild wheat and barley 13,000 years ago, well before those grains were domesticated. The two discoveries suggest that our prehistoric ancestors were bakers and brewers thousands of years before they even contemplated becoming full-time farmers.

—ERIC A. POWELL

Natufian stone fireplace

ERIES OF 2018

**TOP
10**

OLDEST SKETCH

Blombosfontein Nature Reserve, South Africa

The world's oldest known drawing has been identified on a small stone flake recovered in South Africa's Blombos Cave. The tiny fragment measures less than two inches long and barely half an inch wide and features a crosshatch pattern of visible lines. A research team first used microscopic and chemical analysis to determine that the marks are composed of ochre pigment lying on the flake's surface. They then attempted to replicate the pattern using pieces of ochre. Doing so required a firm hand and controlled motions, explains Christopher Henshilwood of the University of Bergen. This led his team to conclude that a human deliberately applied them with an ochre crayon around 73,000 years ago. "The design almost certainly had some meaning to the maker," Henshilwood says. "It probably formed part of a common symbolic system understood by other people in their group."

—MARLEY BROWN



Blombos Cave

Decorated
stone flake

**TOP
10**

AN ECCENTRIC ARTIFACT

Prêles, Switzerland

Swiss archaeologists were baffled when they first saw the bronze hand wearing a gold foil bracelet. All the evidence—including radiocarbon dating of vegetable glue used to affix the gold foil and the style of a bronze dagger found along with the hand—suggests the unusual artifact was fashioned in the mid-second millennium B.C. But nothing like it

is known from the period.

At the site where the hand was found—a spectacular plateau in the shadow of the Alps and the Jura Mountains—archaeologists unearthed a man's skeleton, along with a missing finger from the bronze hand as well as a bronze pin and spiral and several gold flakes. The hand's purpose is enigmatic. "It may have been

this man's insignia," says Andrea Schaer of the Archaeological Service of the Canton of Bern, "and when he died it was buried with him." She says the hand also may have served as a symbolic replacement for one perhaps lost by the man during his life, though it is too delicate to have been a practical prosthetic.

—DANIEL WEISS



Clockwise from top: Bronze hand, bronze dagger, bronze spiral, gold flakes, bronze pin

TOP
10

BRONZE AGE PLAGUE

Samara, Russia

The bacterium that causes bubonic plague, *Yersinia pestis*, has been responsible for some of the most devastating pandemics in history, including the Black Death, which killed more than half of Europe's population in the fourteenth century. The first recorded outbreak was the sixth-century A.D. Justinian Plague, but researchers have now found evidence that a virulent form of the bacterium was circulating at least as early as 1800 B.C.

The team sequenced the genomes of *Y. pestis* recovered from two Bronze Age skeletons—one male and one female—buried together in southwestern Russia. They determined that the strain with which the pair was infected had developed mutations

that allowed it to be carried by fleas. Researchers are unsure how earlier known strains of the bacterium were spread, but they are certain that fleas spread plague efficiently, allowing it to reach pandemic levels. “We know of a lot of historical outbreaks of disease for which the causes have not yet been identified,” says Maria Spyrou of the Max Planck Institute for the Science of Human History. “Now that we know that *Y. pestis* has been capable of causing epidemics in humans for the past 4,000 years, we have to start screening more material to determine whether it could have been involved.” The team hopes to find evidence of early plague outbreaks that have gone unrecorded.

—DANIEL WEISS

Bronze Age skeletons





EARLY AMERICANS

Florence, Texas

One of the most intriguing questions in American archaeology is, Who were the earliest people in the Americas? For much of the past 80 years, scholars have thought that they were members of the Clovis culture, whose ancestors came to North America from Siberia some 13,000 years ago. In recent decades, however, archaeologists have come to believe that people reached North America far earlier. A new discovery from the Gault site, in central Texas, offers robust evidence not only for a much earlier peopling of the Americas, but also of a previously unknown tool tradition that is older and more varied than scholars ever expected.

Archaeologists have found stone tools including projectile points, blades, and flake tools at the Gault site, the oldest of which date to between 20,000 and 16,000 years ago, thousands of years older than any of the fluted stone spear points for which the Clovis are known. “What we’re seeing is a well-developed toolkit,” says Tom Williams of Texas State University. “These were clearly people adapted to surviving in their environment.”

—LYDIA PYNE



Stone tools



EPIC FIND

Olympia, Greece

When an inscribed brick was first found amid a heap of discarded building material in a village outside the sanctuary of Zeus at Olympia, it appeared to be nothing special. Now, to researchers’ great surprise, they have learned it contains an excerpt from the *Odyssey*, the epic poem that tells of the Greek hero Odysseus’ 10-year journey following the Trojan War. The poem, which relates events of the twelfth century B.C., is thought to have been composed in the eighth century B.C. and was first written down in the sixth century B.C. Based on the style of its lettering, researchers have dated the newly discovered excerpt to the third century A.D. at the

latest. They believe it is likely the oldest inscribed section of the *Odyssey* ever found in Greece.

The inscription consists of the first 13 verses of the poem’s fourteenth book, in which Odysseus finally returns home to Ithaca, where he is reunited with his trusted swineherd, Eumaeus. “I think the brick was inscribed at some point, and later it was used for construction,” says Erofilis-Iris Kolia, director of the Ephorate of Antiquities of Ilia. Kolia adds that, in her opinion, the inscription was originally commissioned by a landowner in Olympia who fancied himself a latter-day Odysseus.

—DANIEL WEISS

**TOP
10**

RETURN TO POMPEII

Pompeii, Italy

Despite more than 250 years of almost continuous exploration, fully one-third of the ancient city of Pompeii had never been excavated. In 2018, this all changed.

The A.D. 79 eruption of Mount Vesuvius left the city buried under volcanic material, creating a nearly perfect record of the day's activities—bread baking in ovens, houses under renovation, gardens being tended. But, in the unexcavated sections, all that mud, ash, and hardened bits of lava called lapilli has been collapsing and sliding toward previously excavated properties. This threatens the safety of both visitors and the ancient houses. "Something had to be done," says Massimo Osanna, general director of the Archaeological Park of Pompeii.

The array of frescoes unearthed during the first large-scale excavations of the previously unexcavated area called Regio V, one of the nine regions into which archaeologists divide the city, has been truly extraordinary. And, says Osanna, "They are the first to be uncovered using the most up-to-date techniques of analysis, conservation, and preservation."

—JARRETT A. LOBELL



Fresco



Street, Regio V



Inscribed brick

But Odysseus went up from the harbor by the rough path up over the woodland and through the heights to the place where Athena had showed him that he would find the noble swineherd, who cared for his property above all the slaves that noble Odysseus had acquired.

He found him sitting in front of his house, where his court was built high in a place with a wide view, a beautiful great court with an open space around it. This the swineherd had himself built for the swine of his master that was gone, without the knowledge of his mistress and the old man Laertes. With huge stones he had built it, and set on it a coping of thorn. Without, he had driven stakes the whole length, this way and that, huge stakes...

The Odyssey, Book 14, lines 1–13



**TOP
10**

MUMMY WORKSHOP

Saqqara, Egypt

At the vast Egyptian necropolis of Saqqara, German and Egyptian archaeologists have unearthed a type of ancient funeral parlor. This establishment, the first of its kind ever identified, provided mummification services as well as communal burial chambers for the dead. It has revealed tantalizing new clues to how mummies were made during the Saite-Persian period of the mid-first millennium B.C.

The rectangular building, composed of mudbrick and

limestone blocks, contained large vats where bodies and linens were prepped for preservation. At the bottom of a 40-foot-deep shaft, the team found an embalming chamber where hundreds of ceramic bowls and cups were stored. Many of these vessels had labels listing specific oils and substances, along with instructions for how they should be used in the mummification process.

From the workshop's open courtyard, a nearly 100-foot-long tunnel led down to a series of burial chambers that contained dozens of mummies. One stone sarcophagus, belonging to a lady named Tadihor, was surrounded by dozens of protective faience ushabti figurines inscribed with her name. A painted and plastered wooden coffin identified its occupant as the second priest of the mother goddess Mut and a priest of the goddess Niut-shaes, a serpent form of Mut. Placed over the mummy's head was a rare gilded silver mask, with inlaid calcite, obsidian, and onyx eyes. "Gilded silver masks had deep religious meaning," says project leader Ramadan B. Hussein of the University of Tübingen. "Egyptian religious texts indicate that the bones of the gods are made of silver and their flesh is made of gold. A mummy mask of silver and gold is a step toward the transformation of the deceased into a god."

—JASON URBANUS

Gilded silver mask





HOMININ HYBRID

Denisova Cave, Russia

Genetic testing of a single, 90,000-year-old sliver of bone from an approximately 13-year-old girl has confirmed something researchers had long suspected: It has provided clear evidence of interbreeding between two distinct groups of early humans.

Earlier analysis of the girl's mitochondrial DNA had shown that her mother was of Neanderthal ancestry. The new research, led by paleogeneticists at the Max Planck Institute for Evolutionary Anthropology, examined her entire genome. They then compared it to previously sequenced paleogenomes, including those of other ancient humans. The results were unambiguous—the girl's DNA matched Neanderthal and Denisovan genomes to an equal degree. She had a Neanderthal mother and a Denisovan father. Denisovans were a type of early hominin named after the cave in the Altai Mountains of present-day Russia where their remains were found around a decade ago. “When I first saw the combined Neanderthal and Denisovan ancestry, I got worried that I had made a mistake in the lab, and that this was somehow a mix-up of two different bones,” says Max Planck's Viviane Slon. “It was only after repeating the experiments several times, and consistently seeing the same result, that I

Bone fragment, multiple views



convinced myself—and my colleagues—that the girl's mixed ancestry was real.”

The team's finding of a direct offspring of a Neanderthal and a Denisovan implies that individuals from the two groups mixed when they had the opportunity to meet. “Taken together with evidence that Neanderthals and Denisovans also mixed with ancient modern humans,” says Slon, “this suggests that different groups of humans have always mixed when encountering each other.”

—LYDIA PYNE



ANCIENT SHIPWRECK

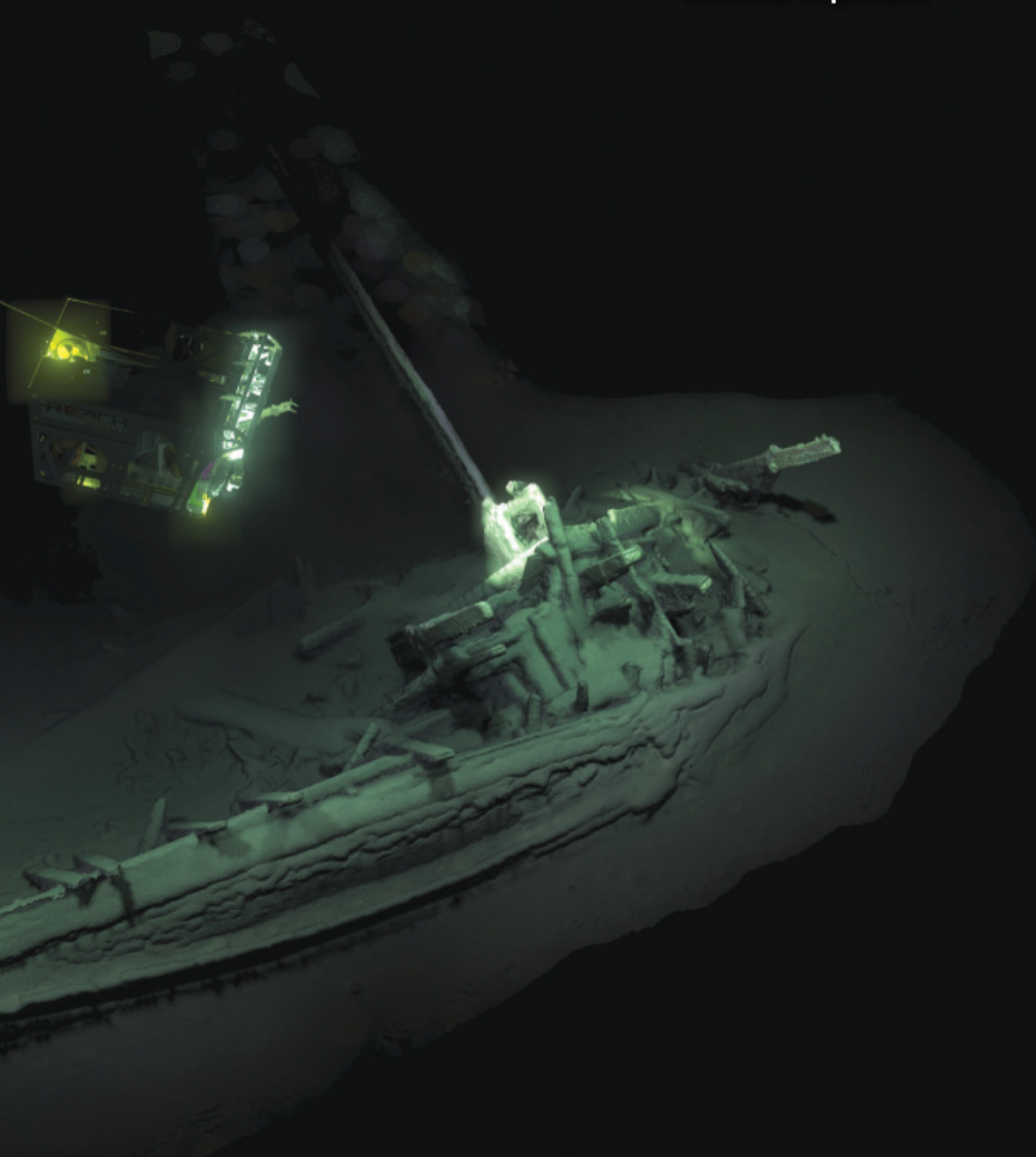
Black Sea

A Greek merchant ship discovered more than a mile under the surface of the Black Sea has been radio-carbon dated to 2,400 years ago, making it the world's oldest known intact shipwreck. The vessel was located by the Black Sea Maritime Archaeology Project as they surveyed the seafloor some 50 miles off the coast of Bulgaria with a remote deep-sea camera system.

The 75-foot-long wooden ship remains remarkably well preserved because the Black Sea's depths are oxygen-free. This has allowed experts to examine elements of ancient ship construction for the first time, including the design of the mast, twin rudders, and rowing benches. “A ship, surviving intact, from the Classical world is something I would never have believed possible,” says Jon Adams of the University of Southampton. “This will change our understanding of shipbuilding and seafaring in the ancient world.”

—JASON URBANUS

Classical shipwreck



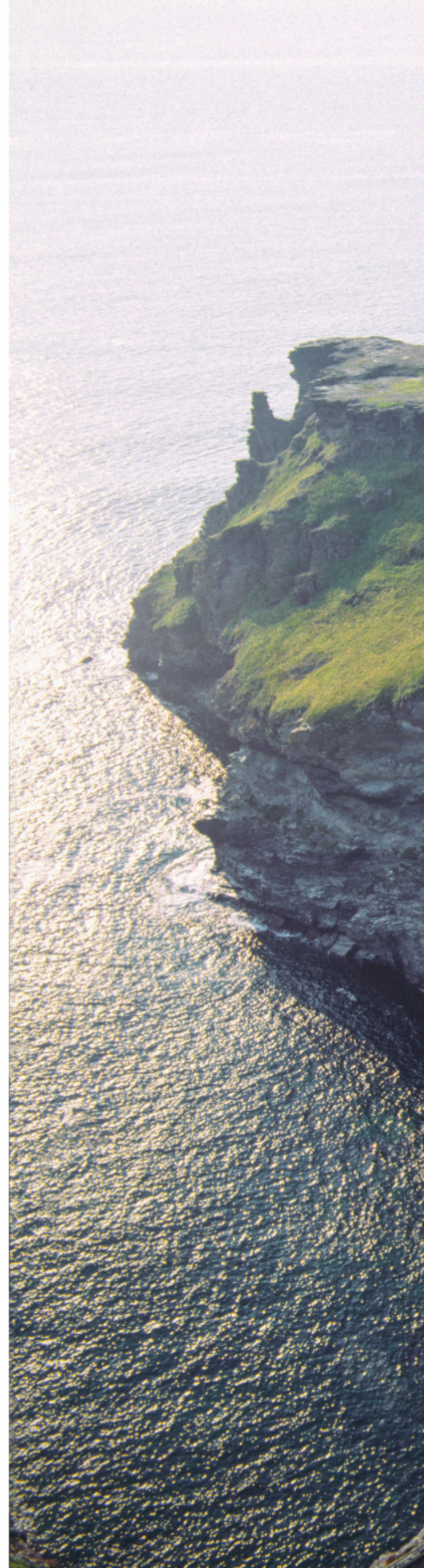
A DARK AGE BEACON

Long shrouded in Arthurian lore, an island off the coast of Cornwall may have been the remote stronghold of early British kings

by JASON URBANUS

AT THE BEGINNING OF the fifth century A.D., the people of the province of Britannia found themselves living outside the borders of the Roman Empire for the first time in more than 350 years. The previous centuries had been prosperous ones for the citizens of Rome's most northwesterly territory, but their circumstances would soon change radically. The diverse population, made up of native Celtic Britons, the offspring of Roman soldiers, and immigrants from elsewhere in the empire, faced an uncertain future. The collapse of Roman Britain ushered in a period known in the popular imagination as the Dark Ages. It's an era commonly thought to have been characterized by economic breakdown, cultural deterioration, and mass invasion by pagan Germanic peoples such as the Angles, Saxons, and Jutes. After the dissolution of a central Roman ruling body, Britain began to fracture politically into several small kingdoms. Few written sources date to the time, making it one of the least documented and least understood periods in British history.

Hundreds of years later, medieval writers who chronicled early British history portrayed post-Roman Britain as a mystical time of warlords and epic battles, of monsters, dragons, and wizards. It was also the age of King Arthur, Britain's greatest legendary hero, who was said to have led the Britons to victory against the Germanic invaders. It is difficult for scholars to disentangle the reality of life in the early Dark Ages from the many myths associated with it, as there are few established facts upon which archaeologists and historians can rely. But recent excavations on the shores of



The ruins of Tintagel Castle sit on a dramatic headland attached to southwest England's Cornish coast.





Archaeologists are excavating a complex of three well-preserved post-Roman buildings on Tintagel's southern terrace.

Cornwall at Tintagel Castle, a place inextricably intertwined with Arthurian legend, have revealed new evidence about life in post-Roman Britain that seems to contradict the traditional Dark Age narrative. Archaeologists now believe that here, in one of the most remote places in England, a settlement unlike any other thrived from the fifth through eighth centuries. As the new story of Tintagel shows, this era in Britain's history was anything but dark.

TODAY, THE APPROACH to Tintagel resembles something out of a fantasy movie. A sharp descent from a nearby village winds through a deep, narrow ravine before eventually leading to a small hidden cove. From there, the ruins of a castle suddenly rise up out of the Celtic Sea, seemingly out of nowhere. While Tintagel is known as an island, it is actually a craggy headland jutting out into the water, tethered to the coast by a thin, rocky spit of land. It is currently accessible only by ascending a steep, and, at times, daunting staircase. As dramatic a setting as it is, hundreds of thousands of visitors make the pilgrimage here each year for another reason—to follow in King Arthur's footsteps. Arthur's association with Tintagel Castle dates back nearly a thousand years. The British cleric Geoffrey of Monmouth's widely read twelfth-century *History of the Kings of Britain* records that Arthur was conceived

at Tintagel Castle, the product of a duplicitous union between Uther Pendragon, King of Britain, and Ygerna, Duchess of Cornwall (see "Was There a Real King Arthur?" page 38). Although little is known about Monmouth himself, his epic book propelled him into the role of de facto national historian of England. His Arthurian tales were particularly popular with the literate upper classes. In fact, most of the standing remains visible at Tintagel belong to a thirteenth-century medieval castle that was directly inspired by the legend. One of Europe's wealthiest men, Richard, Earl of Cornwall and brother of King Henry III, reportedly read Monmouth's account and was moved to build a romanticized fantasy castle on the supposed spot of King Arthur's conception.

Scattered around the ruins of this medieval castle are the footprints of much older, smaller rectangular buildings. These are the remains of post-Roman Tintagel. English Heritage, the organization that manages the site, recently commissioned a five-year project to better understand this settlement. "The impetus of this project is to interpret Tintagel's earlier history, which, for me, is more important than the later castle," says Win Scutt, English Heritage properties curator.

Jacky Nowakowski, principal archaeologist at the Cornwall Archaeological Unit, leads the excavations. She is quick to note that her team is not digging to unearth evidence of

the real King Arthur, but instead to examine what Dark Age life was really like at Tintagel, and why the site's legendary connections endured. "What we're attempting to do is to try to work out what underlies all those myths and legends that are attached to Tintagel," she says. "Because it's quite clear that this was an important place."

THE FIRST EXCAVATIONS at Tintagel began in the 1930s, and researchers returned throughout the twentieth century. Given the small, cell-like appearance of some of the buildings, archaeologists once believed that Tintagel was the site of a secluded monastery, an interpretation researchers now question.

Nowakowski and her team are focusing on a previously unexcavated terrace clinging to the headland's southern slope. They have found a complex of three well-preserved early buildings, the largest of which is an impressive 50 feet long with three-foot-thick walls. Tintagel's inhabitants not only built heavily on the relatively flat central plateau of the site, but they constructed terraces along the steep hillsides in order to create more habitable land—no easy task, but one that must have been necessary. "Why would you build in such precarious positions if the whole island is not densely populated?" asks Scutt. "The civil engineering that went on at this site is phenomenal."

Although only around a tenth of the island has been excavated, research suggests that as many as 100 post-Roman buildings may be spread around the site. Scholars have long thought that large settlements simply didn't exist in the post-Roman period. Sizable towns such as Londinium (London), Camulodunum (Colchester), and Verulamium (St. Albans) were the socioeconomic, political, and religious heart of Roman Britain. These urbanized centers became obsolete after the end of Roman rule and their populations dramatically declined as people dispersed into the countryside. If the team's projections are correct, Tintagel might have been the most densely occupied site in all of Britain. "This is bigger than London," says Scutt. "It's the biggest in Britain. It's quite phenomenal because we don't have anything to compare it with."

Nowakowski chose to focus her excavation on the terrace because it is less susceptible to the erosion that affects other parts of the site. It did not disappoint. "We have cultural material, five feet deep, that is producing a huge number of finds," she says. The level of preservation of what they have discovered, from ceramics to animal bones to seeds, has allowed researchers to begin to understand the daily activities, lifestyle, and diet of Tintagel's Dark Age inhabitants. And while there is a paucity of archaeological and cultural material found elsewhere in Britain dating to this period, Tintagel is an exception. More post-Roman pottery has been unearthed at Tintagel



These fragments of French glass are evidence that Tintagel's wealthy occupants imported expensive goods from the continent.

than from all other sites in Britain combined. Together, the finds are revealing that an unusually wealthy and high-status community lived there.

The source of Tintagel's extraordinary size and wealth seems to have been its maritime links to continental Europe. "Rather than seeing it on the edge of the world, on the periphery of things, it's actually well connected," says Nowakowski. Cornwall is known for its abundant metal resources, most notably tin, but also silver and lead. Tintagel's post-Roman inhabitants were likely capable of trading these commodities

within a systematic exchange network that extended along the Atlantic and Mediterranean coasts. New finds show that they acquired luxury goods from places a thousand miles away in the eastern Mediterranean. Amphora sherds unearthed at the site indicate that olive oil and wine were being imported to Tintagel from Iberia, North Africa, and the coast of Turkey. Glass shards also suggest that Tintagel's residents feasted



Stone disks (left) used to seal amphoras and ceramic sherds (below) from Greek amphoras found at Tintagel show that the post-Roman community imported wine and olive oil from distant Mediterranean shores.



using an array of delicate French and Spanish glass vessels, goblets, and bowls. “The glasses may be for drinking wine, but they are also very posh,” says Scutt. “You wouldn’t use them in an ordinary household. It’s an extravagant display of wealth.”

NO PIECE OF EVIDENCE better exemplifies the culture of post-Roman Tintagel than an inscribed piece of slate that was found embedded in a recently excavated building’s wall. Not only is it an exceptional example of post-Roman writing in Britain, but it also suggests the presence of a literate Christian population at Tintagel. While late Roman Britain was officially a Christian society,

Christianity waned in the post-Roman period, thanks in large part to invasion by pagan Germanic peoples. However, the inscribed slate shows that Christian ideals and lifestyles were maintained at Tintagel throughout this period. Another example of writing from the site is the so-called Artognou stone, which was discovered in the late 1990s. This artifact caused a sensation, given the intriguing similarities between the inscribed name “Artognou” and “Arthur,” but experts have since dismissed any historical connection.

According to Michelle Brown, an expert in medieval manuscripts and professor emerita at University College London, the newly unearthed stone dates to the late seventh or early

WAS THERE A REAL KING ARTHUR?

King Arthur has captured the popular imagination in a way that very few legendary characters ever have. The extensive list of books, television shows, movies, and video games that are based on Arthurian lore demonstrates just how ingrained he has become in world culture. But one contentious question has divided both scholars and enthusiasts for centuries: Was there an actual King Arthur who ruled Britain during the Dark Ages?

The main source for the Arthurian legend is Geoffrey of Monmouth’s twelfth-century book *The History of the Kings of Britain*, which chronicles the lives of the earliest British rulers. Although there are a few sparse references to an “Arthur” figure in documents from the ninth and tenth centuries, Geoffrey gives the first extensive account of King Arthur’s life and exploits. The story begins when Arthur is conceived at Tintagel Castle, where the wizard Merlin transforms King Uther Pendragon into the likeness of Gorlois, the Duke of Cornwall, so that Uther can spend the evening with Gorlois’ wife Ygern. Arthur later inherits the British throne at the age of 15 and leads the Britons in several epic battles against the invading Saxons, eventually defeating them. He goes on to extend his empire to Ireland, Iceland, Norway, and Gaul, before being betrayed by his nephew Mordred and killed in battle.

While many familiar aspects of King Arthur’s story are included in Monmouth’s version, he does not mention Camelot, Lancelot, the Holy Grail, the sword in the stone, or the chivalric Knights of the Round Table. According to Bournemouth University archaeologist Miles Russell, many details were added to the stories centuries later to make Arthur a more appealing figure. “Truth be told, the Arthur of Geoffrey of Monmouth is a deeply unlikable sociopath, a violent, quick-to-anger, murderous thug,” says Russell. “He is someone who very much fits the Dark Age idea of a successful king, but not a hero for the Middle Ages.”

Monmouth’s account of Arthur is frequently derided by today’s historians, as it was even by his own peers. At best, he is chastised for getting his facts wrong; at worst, he is accused of inventing the entire tale. Monmouth himself



An illustration from a 14th-century illuminated manuscript known as the Rochefoucauld Grail depicts King Arthur leading his army against the Saxons.

claimed to have simply translated a very ancient book into Latin, but that source material has never been identified. Furthermore, no proof of Arthur’s existence has been uncovered, even at Tintagel. “There is no evidence that anyone called Arthur lived there,” says Russell. “Nor is there any archaeological evidence to support the existence of Arthur as a real person.”

Russell believes that Monmouth cobbled together various different ancient tales, characters, and episodes to create his now-beloved Arthur figure. It is not an entirely original story, as it borrows heavily from the exploits of other well-known legendary rulers, especially Ambrosius Aurelianus, another British warlord who won a decisive battle against the invading Anglo-Saxons. “It’s clear that rather than inventing everything, Geoffrey used a variety of sources, including folklore, chronicles, king lists, dynastic tables, oral tales, and bardic praise poems, in order to create a patriotic British narrative,” he says. “Arthur is an amalgam of at least five characters. He is, in effect, a composite Celtic superhero—the ultimate warrior for the Britons.” —JU

eighth century and its writing style, language, symbols, and phrases are central to understanding the people living at Tintagel. The engraving consists of seven lines, with only a few words or letters per line. Its overall meaning is difficult to decipher, but valuable information about the scribe who wrote it can be gleaned from studying its composition.

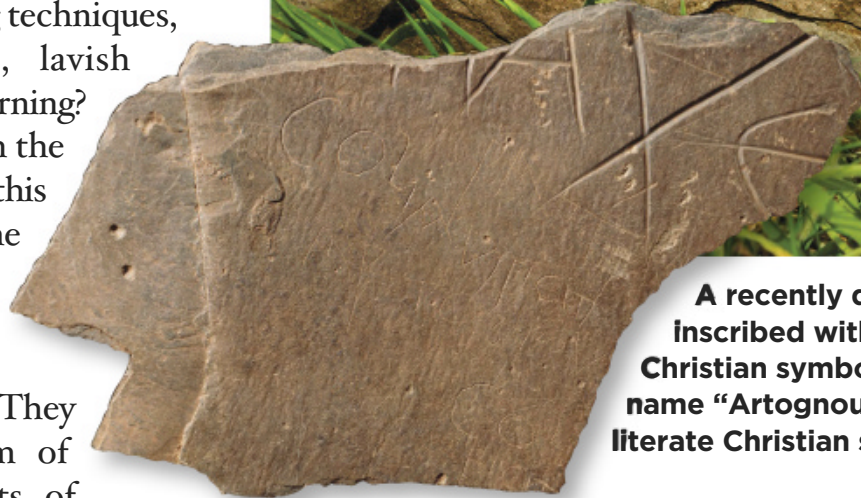
The inscription's opening line contains the Latin name Tito ("for or by Titus"). It also contains two local Brittonic names, Budic, and Tud or Tuda. While the scribe displayed his knowledge of Latin with phrases such as *virī duo* ("two men") and *fili* ("sons"), he must have also been at least somewhat familiar with Greek, given the inclusion of a delta, the Greek letter D. The ornate style of some of the letters suggests the scribe was also acquainted with Christian manuscripts of the time. Brown believes the inscribed stone was unlikely to have been a finished product intended for display, but was used as a kind of exercise piece on which the scribe may have been practicing his formal handwriting. Nevertheless, the stone speaks to the surprisingly cosmopolitan tenor of the period, and of Tintagel itself. Says Brown, "The presence of Latin, Celtic, and Greek elements in the inscription, and familiarity with the sorts of scripts carved on stone, scratched on wax tablets, and written with the pen in gospel books reveal a complex society which looks to its native and Roman past and to its continued international relationships."

WHO WERE THE people capable of such sophisticated building techniques, long-distance trade, lavish displays of wealth, and religious learning? "It has to be something to do with the geopolitics that are taking place at this time," says Nowakowski. After the collapse of Roman rule and the ensuing political fragmentation, local Brittonic chieftains were thrust into positions of power. They eventually formed the Kingdom of Dumnonia, which includes parts of today's Devon and Cornwall. Nowakowski and others now believe it is likely that the kings of Dumnonia also founded Tintagel as a stronghold at a strategic location along the coast. But Scutt points out that Tintagel was a complex and diverse community that can't be so simply defined. "The orthodoxy now is that it's a royal site," he says, "but, actually, we are coming to the conclusion that it was probably a mixture of things—of trading, of religious activity, of administration, as well as a center of prestige and power. Tintagel is one these little sort of sparks along the Atlantic coast that seem to preserve and keep the light of the Roman idea shining."

Archaeologists still aren't certain why Tintagel declined



A recently discovered slate stone (above), inscribed with Latin phrases, Greek letters, and Christian symbols, and a stone inscribed with the name "Artognou" (left) suggest the presence of a literate Christian society at Tintagel.



around the eighth or ninth century. By Geoffrey of Monmouth's time, there was little left of the once-prosperous town. Perhaps the great Dark Age settlement survived in the collective memory of the local inhabitants, and that is why Geoffrey chose it as the starting point of his King Arthur saga. Whether or not the site's connections to the ancient kings of Britain are real or imagined, those links have endured for almost two millennia. Tintagel Castle is currently owned by the Duke of Cornwall, better known as Charles, the Prince of Wales, heir to the British throne. ■

Jason Urbanus is a contributing editor at *ARCHAEOLOGY*.

What Sank *San Diego*?

Was it a German torpedo, a mine, or saboteurs that sent this imposing World War I ship to the bottom of the Atlantic?

by JARRETT A. LOBELL

THE ONLY SHOTS FIRED at U.S. soil during World War I landed near the small town of Orleans, Massachusetts, on the east coast of Cape Cod, on the morning of Sunday, July 21, 1918. The bombardment came from two massive guns mounted on the deck of German submarine *U-156*. More than 100 shells were aimed at the steel-hulled tugboat *Perth Amboy* and the barges she had in tow, as part of the German effort to sink as many ships in as little time as possible. The tug was badly damaged and the barges were sunk, but the shells that went long did no harm on land, falling into a marsh and onto Nauset Beach, a 10-mile stretch

from Orleans to Chatham. To rescue the men, women, and children who had been on the tug and barges, Station No. 40 of the U.S. Life-Saving Service, a precursor of the Coast Guard, deployed an unarmed surfboat. To provide cover for the rescue and target the enemy vessel, U.S. Navy single-engine Curtiss HS-1L floatplanes, which patrolled for subs, were deployed from the recently established naval station in Chatham. Small, fast boats called submarine chasers stationed at New York Naval Base or moored at Gravesend Bay were summoned off patrol. All 32 people on board the tugs and barges were saved.

About 1,000 residents watched from the beach as one floatplane experienced engine trouble and had to return to



A 1920 painting by Francis Muller, an artist for the U.S. Bureau of Ethnology, depicts the sinking of the armored cruiser USS *San Diego* (ACR-6) off the coast of Long Island on July 19, 1918.

the naval station. Another floatplane dive-bombed the submarine. On its first attempt, the bomb release failed, on the second, the bomb release failed again, and on the third try, Chief Special Mechanic Edward Howard jumped out onto the wing and released by hand the only bomb he had, from well below the minimum recommended safe altitude. The bomb landed within a few feet of the submarine, but it failed to explode. Another attempt on *U-156* made by Captain Phillip Eaton in his open-cockpit Curtiss R-9 seaplane was similarly unsuccessful—his bomb also failed to explode. Frustrated, he threw whatever he could lay his hands on, including a monkey wrench, other tools, and even his toolbox, out the plane

windows at the sub. It likely didn't matter—about 90 minutes after the attack on Orleans had begun, *U-156* slipped quietly underwater and was gone.

TWO DAYS BEFORE the “Attack on Orleans,” *U-156* had been at the center of another singular event in U.S. naval history, the sinking of USS *San Diego* (ACR-6), the largest American warship to be lost in World War I. *San Diego* was a 13,680-ton coal-powered armored cruiser, one of six ships designed at the turn of the twentieth century to protect U.S. shipping lanes and overseas territories.

These *Pennsylvania*-class vessels were fast and maneuver-



***San Diego* (above) is shown in a 1915 photograph, when she served as the flagship of the Pacific Fleet. A portrait photograph (right) of *San Diego*'s captain, Harley Hannibal Christy, taken in June 1929.**



able. USS *California* (*San Diego*'s original name before it was changed when the Navy ordered that only battleships be named after states) served for more than a decade in the Pacific Fleet. She was the first naval vessel to enter the newly established base at Pearl Harbor, and she patrolled the Philippines, China, Japan, and Central America. In September 1914, the just-renamed *San Diego* became the Pacific Fleet's sometime flagship. After the United States entered the war, in April 1917, she was reassigned to the Atlantic Fleet as an escort for troop convoys leaving the crucial ports of New York and Halifax to navigate the dangerous, German submarine-infested waters of the North Atlantic.

IN MAY 1915, a German U-boat sank the British ocean liner RMS *Lusitania* off the southern coast of Ireland, killing around 1,200 passengers and crew, including more than 120 Americans. "The sinking of *Lusitania* provoked such a negative reaction that protests were launched in the United States, and the Germans backed off unrestricted submarine warfare for a time," explains retired Rear Admiral Samuel J. Cox, who is now the director of the Naval History and Heritage Command (NHHC). By 1917, though, with both sides increasingly desperate and the war at a stalemate, the Germans officially reinstated unrestricted submarine warfare everywhere but the coast of the United States, Cox says. German subs attacked and sank ships at will, throwing away centuries of naval custom known as "cruiser rules" or "prize rules" that protected merchant and passenger ships from attack without warning and allowed those aboard to disembark and be carried to safety.

Five very large, unarmed merchant subs, or U-Kreuzers,

were converted to warships that could reach the East Coast of the United States and operate there independently for more than a month. *U-156* was one of these submarines. The U-Kreuzers' aim was to attack troop convoys, sink vessels, cut communications cables, lay mines, and block shipments of food, raw materials, and munitions to Great Britain, as well as siphon American anti-submarine forces away from the war zone. One of the other U-Kreuzers, *U-151*, sank six merchant and passenger ships and damaged two more off the coast of New Jersey in just two hours in June of 1918. The Germans also wanted to draw the United States into the war on the side of the British and the French before the country was truly prepared. "The Germans gambled that we wouldn't be ready and wouldn't be able to get our troops to Europe, and that even if we could, the U-boats would sink the transport ships," says Cox. "Clearly, it wasn't a good gamble."

ON THE MORNING OF July 19, 1918, *San Diego*, under the command of her captain, Harley Hannibal Christy, set off for New York from Portsmouth, New Hampshire. Christy had checked for reports of submarines. There were none. Nevertheless, he posted a new watch of the usual 17 men as look-outs at 11 a.m., ensured that all the ship's doors were dogged (latched closed) and watertight.

He set a zigzag course down the coast, the approved method for avoiding torpedoes. Christy reached the shipping lanes off Fire Island, just 60 miles east of New York City, within sight of the coast of Long Island. He and his crew never saw what hit them. An explosion tore through *San Diego*'s port side at 11:05 a.m. The ship began to list, her engines stopped functioning, she took on water, and Christy ordered his 1,182 sailors to abandon ship. *San Diego* sank in less than half an hour from the time she was hit, eventually coming to rest upside down on her stacks about 100 feet below the surface of the Atlantic Ocean. All but six sailors were rescued. Of the six, two were killed in the explosion and the others died while the ship was being evacuated.

Two days later, the destroyer USS *Perkins* arrived at the site to confirm the sunken ship's identity. A Navy gunner named Williamson, who dove down to the wreck, was the first to see the damage to *San Diego*. "There is a large hole on the port side abreast number four smoke pipe and above five feet in diameter," reads the report of Forney Moore Knox, *Perkins*' commanding officer. "The hole is about twelve feet below the water line. There is a large bulge, outwards, just below the hole and the plates are torn outward. From the appearance of the edges of the plate Williamson believes the explosion was from inboard to outboard." What made the hole is a question that has perplexed naval historians for nearly a century.

Others would dive the wreck of *San Diego* after Williamson. At one point the Navy sold her for \$14,000 to be salvaged for

scrap, but this private effort was abandoned and she reverted to Navy property. The wreck has also long been the target of illegal salvage by recreational divers foolish enough to approach—in only five to 10 feet of visibility—a 100-year-old shipwreck that still contains unexploded ordnance. At least six divers have died during these unauthorized visits.

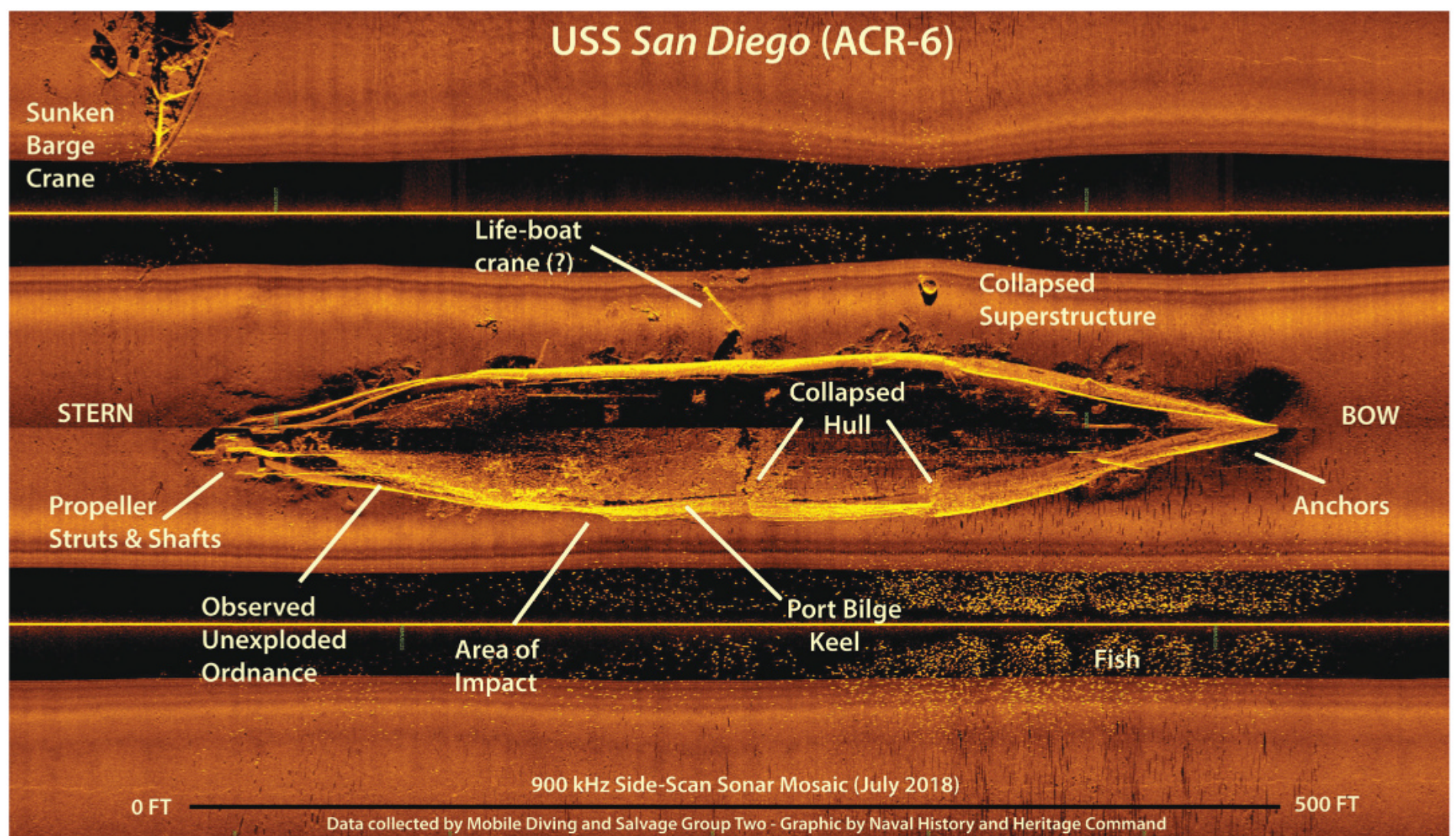
Over the last few decades, archaeologists have periodically visited the wreck to assess its condition and investigate the cause or causes of her sinking. The most recent effort, led by NHHC's Underwater Archaeology Branch, began in 2016 and concluded in 2018. The goals of this expedition, explains NHHC archaeologist Alexis Catsambis, were to honor the ship and her crew on the centennial of her loss, to learn more about her, and to determine why she sank. Although the Navy rarely explores shipwrecks or shares their exact coordinates, it was thought necessary to reexamine the wreck so it could be managed properly. And *San Diego's* location had been widely known for a century. "We do need to be certain where our ships are and of their condition so that if someone does disturb them, they can be prosecuted under the Sunken Military Craft Act," says Cox. But it is much more than that. "These wrecks are usually war graves," says Cox, "and even if they were lost to weather, they are still the final resting place of American sailors. They are the Navy's Arlington National Cemetery. Even if there are no human remains present, it's where our honored dead lie. We consider them hallowed sites."

In his testimony to the Naval Board of Inquiry, which took

place between July 22 and 25, 1918, Christy stated that he suspected his ship had been hit by a torpedo. Although no one reported seeing a sub's periscope or a torpedo's telltale bubble trail, either before or after the explosion, Christy was worried enough a U-boat might surface that he delayed the abandon ship order for about 10 minutes. "It's intriguing to be able to get down to the level of individual decisions of single people in the past," says Catsambis. "It's quite a feat that more than 1,000 men were able to abandon a ship of this size so quickly."

Using both Navy divers and the most advanced technology available, including multi-beam and side-scan sonar mounted on an autonomous underwater vehicle, the NHHC team created a composite digital model of the wreck. A remote sensing survey, conducted in partnership with the University of Delaware, offered the Navy its first look at the site in 20 years. Investigations by divers followed. "The first image we saw of a hole that we suspected was the one from the explosion turned out to be just deterioration of the hull," says Catsambis.

The NHHC team continued their search, and divers found the area of impact reported by Williamson near frame 78, between the engine and boiler rooms, about two-thirds to three-quarters of the way back on the ship's port side. Frames are the ribs of a ship that give the vessel its shape, and the tradition of numbering wooden frames has been retained to refer to steel ships as well. "Divers were able to provide information about the vessel we couldn't see because the angle of the acoustic instruments wouldn't allow it," says Catsambis. "It's amazing



This image of *San Diego* was created in 2018 using side-scan sonar data collected by the Underwater Archaeology Branch of the Naval History and Heritage Command. It shows the ship upside down on the ocean floor at a depth of about 100 feet. Elements of the ship are visible, including her propeller, anchors, ordnance, and the impact area of the explosive that sank her. When she sank, she flipped over, collapsing her superstructure. The sunken barge crane (top left) dates to an unsuccessful private salvage effort.



Dozens of artifacts have been recovered from *San Diego*, including (clockwise from top left): a glazed stoneware officer's plate; an electric lamp; a U.S. Marine Corps Mameluke officer's sword; a steam valve; a U.S. Navy padlock; Springfield rifle ammunition; and a silver plated fork.

to think that 100 years later we are able to trace the steps of Gunner Williamson and assess the existence, location, and size of the holes in the immediate vicinity of the fateful explosion.” But with the degradation of the hull potentially masking the original damage from the explosion, this line of inquiry had so far proved inconclusive. Was it a mine or a torpedo, or perhaps even sabotage that sank *San Diego*? “We approached this question with an open mind and considered all the options,” Catsambis says. “Modeling the impact of different munitions on the ship is helping us to project what may have sunk her, and the data is building toward a case.”

The team is now looking at whether they can match the hole in the side of the ship with the types of torpedoes or mines they know the Germans had. The torpedoes in use would likely have created a much larger hole, leaving a mine as the probable suspect. “We do know from contemporary sources that German subs had laid mines in the area where *San Diego* sank,” says Cox. In fact, the Navy found six contact mines—a mine that needs to be touched before detonating—in the vicinity of *San Diego* the day after she sank. One of the submarines known to have been laying such mines was *U-156*.

WHILE CATSAMBIS AND his team shared the opinion that a mine sank the ship, they still wanted to know precisely how and why she sank, especially considering that it was clear from the Court of Inquiry that Christy had done everything correctly to try to avoid being hit and to ensure that the ship would remain afloat even if she were struck. The answer came from research conducted at the Naval Surface Warfare Center (NSWC), Carderock Division, in West Bethesda, Maryland. This facility is home to thousands of experts in maritime technology, including researchers who focus on the effects of underwater explosions on vessels of all types. Working with Catsambis, using the model he and his team created, engineers Ken Nahshon, Michael Kipp, and John Rosborough of NSWC Carderock performed stability analysis to learn about the damage to *San Diego*’s hull and how it would have affected her draft (the hull’s depth below the water) and her trim (the difference in height between the forward and aft ends of the ship) while she was sinking. They also subjected the model to dynamic flooding analysis, which tracks how the ship actually filled with water and sank. “Capsizing is all



In this undated photograph (left), sailors man the fore gun on the deck of the German submarine *U-156*; *U-156* (below) in the Canary Islands after a 4-month cruise from Germany.

about whether a ship can right itself when it’s rolling,” says Nahshon. “We wanted to know what happened in the flooding event to see why *San Diego* sank. It seemed unusual because she was such a large ship, the hole was relatively small—only a few feet across—and she sank so quickly.”

Originally, researchers thought that *San Diego* sank because the damaged side of the ship flooded, but the dynamic flooding analysis showed this wasn’t the case. Having been launched in 1904, *San Diego* was closer in construction to a vessel from the late 1880s than to a modern warship of the type that began to be built in the 1950s and 1960s. This was to be her undoing. The end of World War I was, for all

intents and purposes, the end of the “coal navy.” Ships were already beginning to run on oil, and before long, many would run on nuclear power.

The team now understands that *San Diego* capsized because she had a weight problem, explains Nahshon. Piled on her deck was the enormous quantity of coal needed to power her across the Atlantic. “The sensitivity of the hull to rolling over was high,” he says. The ship was top-heavy, and with so many open passageways used to move the coal around the ship, it was easy for water to rush in once she began to sink. “At first the ship took on a small list,” says Nahshon, “but once the water was going over the gun deck, they knew they were in big trouble.”

Although the sinking of *San Diego* marked the veteran ship’s end, USS *San Diego* lives on. Her namesake ship, an ultra-modern *San Antonio*-class amphibious transport dock used to move heavy equipment, such as helicopters and assault vehicles, was launched in 2010. She is now stationed at Naval Base San Diego. The tug *Perth Amboy* also had a long history after the war. She was restored, sold to Great Britain, put into service, and ended up at Dunkirk, where she evacuated French civilians during World War II. *U-156*, on the other hand, which sank more than 30 ships and laid the mines that sank *San Diego*, was destroyed on September 25, 1918. While crossing the Northern Barrage, a massive field of at least 100,000 mines laid in the North Sea to keep the Germans from entering the Atlantic Ocean, she was sunk by an American mine. ■

Jarrett A. Lobell is editor in chief at *ARCHAEOLOGY*.

THE MAYA ANIM

Captive big cats might be key to understanding ancient Mesoamerica's complex

IN THE YEAR A.D. 776, the warrior-king Yax Pasaj Chan Yopaat, the sixteenth and final ruler of the Maya city of Copan, built a temple. In front of the temple, he dedicated an altar to the city's founding three and a half centuries earlier. There, archaeologists believe, he ordered the sacrifice of 16 big cats, including jaguars, pumas, and an ocelot. A cat is thought to have represented each of his 15 predecessors, who are depicted on the temple's altar in a succession ending with Yax Pasaj Chan Yopaat himself. The sacrifice, archaeologists say, was an act of desperation. Deforestation and environmental degradation threatened the end of Copan, requiring a public demonstration of the ruling dynasty's strength and an appeal for divine intervention.

From the fifth to the ninth centuries, Copan thrived in a particularly fertile valley. Until the city succumbed to over-farming and a subsequent political collapse, it was blessed with abundant natural resources, including a nearby source of jade, macaws, whose feathers were highly prized, and jaguars, whose pelts were valuable trade commodities. Archaeologist William Fash of Harvard University explains that the city, which was a learned center of hieroglyphic writing and boasted one of the largest ball courts of its time, enjoyed outsize cultural importance that would have drawn people and goods from great distances. "A lot of Copan's cachet was not in terms of political clout," he says. "It was never the largest Maya city, not even close. Caracol, Calakmul, Tikal, and others had much larger footprints, and probably also bigger economies, but Copan was very important in that it was a conduit for finished products, services, and people coming from non-Maya areas."

Copan was also linked to Teotihuacan, the most influential Mesoamerican city-state from the first through the fifth centuries. The kings of Copan, including Yax Pasaj Chan Yopaat ("New Man on the Horizon") drew authority from their connection to Teotihuacan, even after that city collapsed around the year 550 and Copan began to flourish. Stelas on his temple's altar record that the dynasty's founder, a warrior named K'inich Yax K'uk' Mo' ("Great Sun, Green Quetzal Macaw"), traveled to Teotihuacan in 426. Teotihuacan lies nearly 1,000 miles north of Copan, near present-day Mexico City, a journey that took the warrior 152 days. At Teotihuacan, the stelas say, he participated in rituals and learned skills that would legitimize him as a king in his home region. "The altar records the pilgrimage of the founder. He practices a new fire ceremony and is given the implements of office, which he then dutifully brings back to Copan," explains Fash, who has conducted excavations in both Copan and Teotihuacan. It's possible that the

practice of capturing and even rearing jaguars and pumas in captivity—as Yax Pasaj Chan Yopaat did—may have come to Copan directly from Teotihuacan.

ARCHAEOLOGIST NAWA SUGIYAMA of George Mason University began looking for indications of animal captivity at Copan after working at Teotihuacan, where she found the earliest evidence in Mesoamerica of captive carnivores, including pumas, jaguars, eagles, rattlesnakes, and wolves. Sugiyama says, "I thought, well, if this was going on in Teotihuacan, where else in Mesoamerica at the time might it have been occurring?" She tested more than 50 faunal samples recovered from around Copan, including the



AL KINGDOM

network of culture and commerce *by* MARLEY BROWN

remains of the cats sacrificed at the altar by Yax Pasaj Chan Yopaat. According to Sugiyama, the first clue that the cats were kept captive in the city rather than killed in the wild was their sheer number. “The cache of bones found under the altar represents the sacrifice of more than a dozen felids [wild cats], which must have been very difficult to accomplish,” she says. “Felids are very territorial. Think about how your house cat might become fussy if there was another cat in the same territory. Now imagine if that was a jaguar or a puma.”

To further support her theory that the animals were captured and kept before their deaths,



The skull of a sacrificed puma was discovered in the 5th-century tomb of a young adult woman at the Maya site of Copan in Honduras.

Sugiyama conducted stable isotope analysis on the samples, testing for carbon and oxygen isotope ratios. Carbon isotope values indicate what kinds of food a human or animal ate throughout their lives. Oxygen values are mostly derived from water consumed, which reflects the climate and geography of the place the human or animal comes from. “You really are what you eat,” Sugiyama says. “Bones reflect diet, environment, and sources of water, and can help us understand whether an animal lived in captivity or not.” Three feline samples from the altar site showed evidence of diets rich in C₄, a carbon-bearing molecule produced by cultivated plants suited to hot climates. These types of plants are relatively rare in the wild. “Corn, the Maya dietary staple, is a C₄-type grass,” Sugiyama says, “while most of the environment surrounding Copan is made up of what we call C₃ plants.” The majority of plants in the world are C₃, which tend to manufacture energy less efficiently than agricultural crops. “This really sticks out, but it makes sense, because in captivity, jaguars and pumas would be fed a lot of artificial foodstuffs, including corn-fed domesticated animals like turkeys and dogs,” she says.

THE DISCOVERY THAT the Maya at Copan were keeping, trading, and possibly traveling with valuable and dangerous undomesticated animals fits in with a growing body of evidence that Teotihuacan’s influence was far-reaching and powerful. Furthermore, it is now evident that complex connections existed among polities from around the Mesoamerican world separated by language, political allegiance, and ethnicity. This evidence often comes in the form of objects traded over long distances or artistic styles transferred from one region to another. It is clear that ideas and commodities were flowing back and forth between the two cities—and everywhere in between.

Sugiyama and Fash believe that stable isotope analysis has the potential to reveal much about where people and animals were moving as well. “A lot of the applications of this technique have been to human skeletal material and that’s been a revelation,” Fash says. “It’s really blown open our understandings about the nature of Maya cities and how many people were moving all over the landscape.” Says Sugiyama, “These are vast distances but the interaction between Mesoamerican settlements was much more dynamic than we realize. That’s what we’re finding at Copan. They’re moving deer around, they’re moving birds around, they’re moving carnivores around. The real question is, What are they not moving?” ■

Marley Brown is associate editor at *ARCHAEOLOGY*.



A vast mountainside cave in the midst of lush farmland conceals at least 70,000 years of Southeast Asian prehistory

by KAREN COATES

CAMBODIA'S CAVE

WHEN FRENCH RESEARCHERS Cécile Mourer-Chauviré and her husband, Roland Mourer, landed in Cambodia in 1964, they never expected to change history. She was trained as a paleornithologist and he, while stationed under the French military “coopération” program to teach in a local school, was finishing a Ph.D. in prehistoric ceramics and modern pottery making in the province of Kampong Chhnang. Both had worked on excavations of Paleolithic cave sites in France. Although Mourer’s initial posting was for 20 months, the couple ended up staying for six years. Along the way, they made a discovery that transformed not only their lives, but also the accepted record of Cambodian prehistory.

Shortly after they arrived, the Mourers began looking for

potential archaeological sites to explore. They visited the far western province of Battambang, where the governor told them about a cave among limestone massifs near a village called Sdao. A local guide led them to a rural area near the cave, formerly forested but newly planted with crops. The couple traveled by oxcart—no cars could make the rugged trip. “It was a true frontier,” Mourer-Chauviré says. “It seemed very few people had been in the cave before.”

The vast and airy shelter sits about a 10-minute walk up the side of a mountain called Phnom Teak Treang. In a report published in 1970, the Mourers wrote that the chamber is “lit by numerous vents separated by natural vaults in the form of arches.” Those arches give the site its name, Laang Spean, which means “Cave of Bridges.” The scene today is not so very different. Far from the pavement, traffic, and



The limestone mountain known as Phnom Teak Treang in western Cambodia's Battambang province is home to Laang Spean, or "Cave of Bridges," one of the most important archaeological sites in Southeast Asia, with finds dating back as far as 71,000 years.

OF BRIDGES

noise of cities, Phnom Teak Treang juts from the landscape amid acres of fertile fields. A short, steep trail threads up the mountain to the cave's entrance, where an opening leads to a mesmerizing space, cool and dim but for the beams of light that shine through gaps in the cave's rock walls and ceiling. The interior—some 380 feet long, 82 feet wide, and just under 100 feet high—provides welcome respite from the oppressive heat outside. Swallows swoop and serenade, flying among crevices in the stones.

When monsoon rains drench the mountain and the surrounding alluvial plains, plentiful fields of cassava and corn cloak the land in shades of green. In antiquity, too, this land sustained an abundance of wildlife in an environment that supported many cultures. Evidence of three distinct human occupations has now been identified in layers that go back in time

and depth from the surface to 16 feet below. The most recent findings are from the Neolithic period, around 3,300 years ago. Earlier artifacts found at Laang Spean share similarities with those of the prehistoric hunter-gatherer culture known as the Hoabinhian, which is identified here by its stone tools dating to between 11,000 and 5,000 years ago. The culture was first discovered in northern Vietnam in 1927 by French archaeologist Madeleine Colani. Since then, Hoabinhian sites have been identified across Southeast Asia, from northern Vietnam to Thailand, Laos, and some islands of Indonesia, with dates ranging from roughly 10,000 to 2000 B.C. And there is even evidence at Laang Spean of a pre-Hoabinhian occupation that goes back 26,000 years and likely more—much more. In fact, people may have used the cave as long as 71,000 years ago.

It's rare in Cambodia to find sites that have been occu-

pied continually for so long. Archaeological research here has long been primarily concerned with the Angkor Empire, which dominated the region from the ninth to the fifteenth centuries A.D. “Prehistory in Cambodia is not well known,” says Heng Sophady, deputy director general for cultural heritage at the Ministry of Culture and Fine Arts and coleader of a team of French and Khmer archaeologists on a long-term mission to unearth the story of Laang Spean. The cave holds evidence of Cambodian history that extends thousands and thousands of years before Angkor, says Alison Carter, a University of Oregon anthropological archaeologist whose fieldwork focuses on the daily lives and residential areas of Angkorian people. Unlike many sites in the region, she explains, Laang Spean allows scholars to see how different peoples interacted with their environment over many thousands of years. In fact, according to Sophady and his colleagues, Laang Spean is the first major cave excavation where researchers are able to trace not only the archaeological but also the biological, geological, and environmental history of Cambodia. A framework of mainland Southeast Asian prehistory is slowly emerging from the cave. Hubert Forestier of the National Museum of Natural History in France says it is the most important site in Cambodia and in the entire region.

DURING THEIR INITIAL VISIT to Laang Spean more than half a century ago, the Mourers camped and worked for a week, sleeping on the cave floor, eating canned food, and boiling rice on a small gas cooker. “We found that it was really beautiful,” says Mourer-Chauviré. And wild. One morning, she went outside, near a banana field. There, in the dust, was a very large footprint with the impression of pads like those of a dog, “but much larger...the size of a plate,” she recalls. It was the print of a tiger.

On their first day of excavation, the Mourers found a finely chipped flint tool. Further investigation unearthed pottery fragments, burned bones, mollusks, and the remains of



Laang Spean's vast interior, which a team of Khmer and French archaeologists, geologists, paleontologists, and other scientists has been investigating for the past 10 years, holds evidence of at least three different prehistoric cultures.

small animals such as birds, bats, rodents, geckos, and fish, along with rock masses composed of the iron oxide-rich soil called laterite that the Mourers thought were brought to the cave by the people inhabiting it, though nothing more is known about these rocks. They also found two tools made of dark-colored hornfels, a metamorphic rock so named because of its resemblance to animal horn. These discoveries were enough to convince them that further research was essential, and they made plans to continue digging.

The Mourers returned to the cave annually with student archaeologists from the Royal University of Fine Arts in Phnom Penh. Their excavations took them through layers of sediment in which they found an array of short axes, side scrapers, and end scrapers thought to have been used for cutting wood, butchering animals, crushing bones, and scraping hides. The Mourers

also identified layers containing fragments of pottery with grooved bands, incisions, cord impressions, and other decorations. They collected an assort-



Roland Mourer and Cécile Mourer-Chauviré dine in a thatch hut at the foot of Laang Spean in the late 1960s. The couple worked there together until 1970 and uncovered some of the first evidence of Laang Spean's extraordinarily long history.

ment of bones from cattle, rodents, rhinoceroses, bats, birds, frogs, and gastropods, as well as the shells of freshwater turtles.

Initial radiocarbon results were groundbreaking for Cambodian archaeology at the time. They showed millennia of occupation, with some gaps, starting as early as 6800 B.C. This placed some artifacts firmly in the Neolithic period and others at the time of the Hoabinhian culture. “A few prehistoric sites had already been discovered in Cambodia, but it was the first time that Hoabinhian stone tools were found in a cave with a well-defined stratigraphy,” Mourer-Chauviré says. The Mourers’ findings are still considered some of the greatest advances in Cambodian prehistoric research, especially considering that the Neolithic period in Cambodia was “practically unknown,” they wrote in their 1970 report.

JUST AS THE MOURERS were making their pioneering discoveries, the Vietnam War spread farther throughout Southeast Asia. Civil war ruptured Cambodia, and it became impossible to continue their excavations, Mourer-Chauviré says. The United States bombed the country intensively, helping to fuel the rise of Pol Pot and his genocidal Khmer Rouge regime. By 1975, all scientific research in Cambodia had come to a halt. Foreigners were forced to flee, and scientists, teachers, and the educated classes were targeted for execution. “It was terribly sad for us that Cambodia plummeted into war and into the murderous ‘utopia’ of the Red Khmers,” Mourer-Chauviré says. “Most of the students that we had at the university were killed.”

The war lasted longer around Battambang than it did elsewhere. Both Khmer Rouge and Cambodian government soldiers used the province’s caves and mountains as hideouts and battlegrounds. The rocks surrounding Laang Spean still bear scars of weapons fire, and the hills around the mountain still contain deadly land mines. The path and entrance to the cave have been cleared and nearby rocks are marked in red paint with the name of the national clearance organization, Cambodian Mine Action Centre. Sophady was a university student in 1998 when he accompanied one of his professors to Laang Spean for the first time. Military police and soldiers guided the way through a maze of mines. “We had to step in their footprints,” he says.

That expedition concentrated on speleology, not archaeology, and the Mourers’ work remained on hiatus until 2009, when Forestier decided to resume the effort. Thanks to the Mourers, Laang Spean was already known as an important prehistoric cave site. Forestier met with the couple and devised a plan to reopen excavations.

Forestier envisioned collecting new archaeological data to reassess the site’s complex history using improved dating techniques. This would be a joint effort between archaeologists from the Cambodian Ministry of Culture and Fine Arts and Khmer students at the Royal University of Fine Arts, the same university that had sent students to accompany the Mourers some 40 years earlier. “Sophady and I both wanted to make this cave a scientific laboratory,” Forestier says.

The Franco-Cambodian Prehistoric Mission is now 10 years

old. Every year in February and March, archaeologists work with geologists, paleontologists, archaeozoologists, herpetologists, and scientists from other fields to explore the cave. The group has formed a strong bond. “We are all focused on only one thing, one target, one obsession: Laang Spean cave,” says Forestier. Their work always takes place during the dry season, when the land is navigable—a lesson learned after the first excavation in July 2009, which began in the middle of monsoons. “Terrible, terrible,” Sophady says, recalling the dank air and slippery rocks. “It took nearly a day for us to carry our supplies up the mountain.”

During that summer, researchers surveyed a total of 13 caves in the area around Laang Spean, most of which contained evidence of prehistoric occupation. Unfortunately, the archaeological record in those caves had been disturbed by illegal digging and looting. Sophady knows he is racing against time to document and preserve what remains. In recent years, many of Cambodia’s caves have been mined for limestone, a key ingredient in cement. In the process, the caves are often demolished—along with any archaeological evidence. The Cambodian government has protected Laang Spean, but Sophady and his team wonder how much is already lost, and how much more could disappear before they have a chance to record it. “We really worry,” he says.



Red writing outside the cave’s entrance reads “CMAC,” which stands for the Cambodian Mine Action Centre, and indicates that the area has been cleared of land mines.

THUS FAR, MORE THAN 850 square feet of Laang Spean has been excavated. This has revealed not only its long history of occupation, but also the very different ways in which the cave was used over that expanse of time. During the Neolithic, the sedentary people who had likely settled on the nearby Sangker River grew crops, raised animals, and buried their dead in the cave. The team has found six burials with nearly complete, although fragile, remains. These include five men, all with heads pointing south, and one woman turned in the opposite direction. “It’s difficult to interpret,” Sophady says. Perhaps north and south were spiritually significant to the different genders or perhaps the men pointed toward the valley where they hunted. “We can’t say anything further at the moment.”



Tools (above left) belonging to the prehistoric culture known as the Hoabinhian were excavated in an 11,000-year-old layer of artifacts in Laang Spean. More Hoabinhian tools (above right) were found on the surface in another one of 13 caves the team surveyed, most of which contained prehistoric artifacts.

The Laang Spean burials are significant because they are intact and because they provide a definite chronological and cultural marker from which to discuss Neolithic burial practices here—and possibly in other areas of Southeast Asia. Each burial contains a different assemblage of grave goods. Some were found with earthenware pottery, one with a pendant made from a wild boar canine, and yet another with decorative seashells worn as bangles. Says Sophady, “Each burial tells us a different story.” The team also identified evidence of tooth ablation, the removal of particular teeth. Forestier says this practice may be associated with a ritual such as the transition to adulthood. Tooth ablation has also been found among modern populations in China and Laos, as well as regional ethnic groups such as the Jarai in Vietnam’s central highlands and northeastern Cambodia. Near the remains of the woman, named by the team Mrs. S32, excavators uncovered a pot with an infant’s bones inside. This type of Neolithic jar burial is uncommon in the region, Sophady says. “A small baby inside a small pot, it’s very rare.”

When these Neolithic settlers buried their dead, they dug into the cave floor, straight into a layer of Hoabinhian artifacts. In this mixing-up of layers and occupations, Neolithic burial remains have been found among stone tools and sediments dating to the Hoabinhian period. Nevertheless, many tools are clearly attributable to the earlier culture. These include 312 artifacts that closely resemble pebble tools found in other Hoabinhian sites across Southeast Asia. They are continuing to tell the story of Laang Spean’s Hoabinhian occupants. These people were travelers who didn’t build

houses or have villages, Sophady says. They temporarily occupied the cave, hunting and gathering their food nearby and shaping tools from hornfels pebbles, as well as occasionally from sandstone and other rocks gathered from the river. They mostly hunted land animals, but also fished and collected freshwater mussels and oysters.

The Hoabinhians seem to have butchered their large prey outside the cave and

then carried pieces of meat inside. Archaeologists have excavated an enormous number of teeth and bones from deer, boars, rhinos, macaques, gibbons, civets, porcupines, pythons, cobras, and other animals. Many of the remains show evidence of burning, and the findings suggest that the cave’s inhabitants had access to a wide-ranging diet, although the majority of their protein seems to have come from large wild cattle such as banteng and gaur. Some finds are less clear. A crushed human skull was discovered amid the animal bones and stone tools—a curiosity, since the other human remains were associated with Neolithic burials from centuries later.



A Neolithic burial in Laang Spean holds well-preserved grave goods including pottery and bangles. The team has thus far found a total of six burials in the cave, each with its own distinctive artifacts.

FAR BELOW THE SKELETONS of the Neolithic age, buried deeper than the bones of Hoabinhian meals, exists evidence of the pre-Hoabinhians. Artifacts associated with these people, dating to at least 26,000 years ago, are found as little as five and as much as 16 feet below the surface. There, researchers have uncovered flint collected from the surrounding landscape that was knapped to produce small flakes from cores. These tools are unlike the pebble and larger “cobble” tools dating to the Hoabinhian period. For Sophady’s team, the pre-Hoabinhian occupation level is especially important, as Laang Spean is the only prehistoric cave site in Cambodia where evidence of this period has been unearthed.

The very oldest findings are three large cobble tools that Forestier dated to 71,000 years ago. He arrived at this very early date using optically stimulated luminescence, a method that determines the last time a soil layer was exposed to light. Nothing else like this has been discovered in a cave site in mainland Southeast Asia, Forestier says. And although researchers don’t know much about who these early pre-Hoabinhians were, Forestier is not surprised to have found evidence of the culture in Laang Spean. “We know that modern humans were already in southern China between 100,000 and 150,000 years ago,” he says, and that some of these people migrated to Southeast Asia at approximately the same time, following large rivers such as the Mekong, which runs from the Tibetan Plateau through China, Myanmar, Laos, Thailand, Cambodia and Vietnam. Archaeologists have found the same pebble and cobble lithic tradition across this whole area, Forestier adds, and one possible wave of prehistoric migration likely applies to the early inhabitants of Laang Spean.

The team plans to continue to excavate the Hoabinhian levels, as well as to dig deeper into the cave’s deepest pit, some 30 feet below the surface. Forestier would like to uncover artifacts even older than 71,000 years. He says, “I hope—and I think—that the Laang Spean archaeological sequence is the deepest and most ancient human settlement in any cave in mainland Southeast Asia.”

Sophady says he is often asked, Were these early cave dwellers Khmer? Being so close to the border, were they Thai? People often frame their questions in terms of nationality, but for



Heng Sophady (right), coleader of the Laang Spean archaeological project, speaks with a local police officer while standing next to the site’s deepest pit, which extends down 30 feet through millennia of human history.

archaeologists, the early people who made themselves at home in Laang Spean predate national distinctions. The answers to any questions of identity transcend modern concepts of nationality. Going forward, researchers will conduct DNA analyses to learn more about their origins. “But,” Sophady says, “we cannot say anything about the nation of these people.”

So, who were they? Sophady replies, “They were human.” ■

Karen Coates is a contributing editor at *ARCHAEOLOGY*.

For a video of the excavations at Laang Spean, go to archaeology.org/cambodiacave.

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A 2015 excavation at the Lammermarkt site in the center of the Dutch city of Leiden is one of several digs that have exposed centuries-old waste infrastructure.

LETTER FROM LEIDEN

OF CESSPITS AND SEWERS

Exploring the unlikely history of sanitation management in medieval Holland

by **WILL HUNT**

On a balmy July afternoon, archaeologist Roos van Oosten strides through a muddied plot of land near the center of the Dutch city of Leiden and takes an exploratory sniff. The plot, bordered on all sides by apartment buildings, will soon be part of a housing development known as the Meelfabriek, but, for now, van Oosten and a team of excavators from RAAP Archaeological Consultancy are studying the remnants of a 400-year-old neighborhood.

With another sniff, van Oosten gestures to a brick-lined pipe, half obscured with mud. A backhoe rumbles to life and swings its toothed bucket down on the pipe, cracking it open. It is a sewer. Exposed to all present is a stew of squelching, midnight-black muck—excrement that has been brewing for four centuries. Released into the air is an eye-watering aroma, a smell so concentrated and forceful it seems to take shape as a cloud. The excavators stagger back a

step, turning their cheeks as though they've been slapped. Van Oosten peers down into the muck, and, with a lilt in her voice, says, "Jackpot!" She scribbles notes on a small pad. From her backpack she pulls a laminated map of Leiden showing the layout of the walled city in the mid-seventeenth century. She moves her finger across the map, following the route of the sewer pipe.

Van Oosten is a connoisseur of muck. She has spent the last decade

LETTER FROM LEIDEN



An intact brick sewer (left) unearthed in the summer of 2018 at Leiden's Meelfabriek construction site dates to the 17th century, when city officials began to replace individual cesspits with a network of sewers. The contents of the Meelfabriek sewer line (right) are visible after excavators broke through the bricks.

sifting through the cesspits and sewers of medieval European cities, studying how people of the late Middle Ages managed their waste. In society's relationship to its so-called "foul matter," she has uncovered surprisingly intimate details of medieval life. In long-overlooked municipal archives on sanitary infrastructure, she has tapped into civic attitudes to dirt and waste. With a latrine's-eye view of history, van Oosten, along with other scholars, is now challenging the popular vision that the streets of late medieval Leiden—or London, or Paris, or Bruges, or any other sizable city of the time—were dark, gloomy quagmires. In fact, van Oosten says, the humble brick cesspits that characterized urban medieval life in cities such as Leiden were relatively hygienic. It wasn't until cesspits gave way to sewer-based infrastructure in the early modern era that the relationship

between the citizens of Leiden and their waste turned truly foul.

Today, Leiden is a small, placid city of 125,000, where rows of narrow, ivy-covered townhouses line a jigsaw of canals. Situated near the North Sea between The Hague and Amsterdam, it is home to the oldest university in the Netherlands—Leiden University—where researchers have made some of the greatest discoveries of modern science, from the recognition of the Big Bang to the concept of superconductivity. It's a place that has been featured in documentaries about urban planning and efficient infrastructure, where unhurried cyclists glide back and forth over bridges, and boaters on the canals stop to enjoy dockside picnics.

While the excavators sift through the muck at the Meelfabriek in search of artifacts, van Oosten pedals her

bicycle through the streets of the city. As she rides over the cobblestones, she points out vestiges of medieval Leiden that have survived the intervening centuries. Leiden was once a hub of the textile industry, she explains, a place where fabric of all types was processed and then distributed throughout Europe. Down one passage, lining the shaded bank of a canal, were the homes of spinners, weavers, and tuckers, the artisans who manufactured the textiles. Down another street

was the Laecken-Halle—the "Cloth Hall"—the guild house of the wool merchants, where fabric was inspected before being put to market. The medieval city, she says, was a bustling place, far denser than it is today, where neighbors were living one on top of the other.

When van Oosten first arrived at Leiden University in 1998 to embark on an undergraduate degree in archaeology, she carried a mental image of medieval urban life that is widely held in contemporary culture. "Most people think of cities of the time as chaotic, dirty, and full of disease," she says. "It's the stereotype of the 'urban graveyard.'" This is a vision largely created by Victorian-era authors, who were writing on the heels of the Industrial Revolution. To take one example among many, nineteenth-century antiquarian Augustus Jessopp, an authority on the Middle Ages at the

time, described life within the walls of a medieval city as “a dense slough of stagnant misery, squalor, famine, loathsome disease, and dull despair” where the inhabitants “quietly rotted and died.” The physician George Newman, a contemporary of Jessopp’s, described “a society that knew little of decency, cleanliness, and order,” which was characterized by “total neglect of all hygienic or sanitary laws.”

The Victorians gave root to a very specific image of late medieval urban life. Cities were cast as brutish, uncivilized places, ruled by negligent governments entirely indifferent to the health and well-being of their citizens. Butchers tossed entrails and offal into the street. People emptied buckets of excrement out of their windows. City dwellers were said to have trudged to market through drifts of rat-infested garbage and waded through rivers of their neighbors’ feces. Few people bathed, of course, as everyone lived in ignorance of or

indifference to their own stench. In Victorian descriptions of the time, medieval life was an altogether precarious ordeal, where people lived forever a sneeze away from death.

It was when van Oosten began her research on waste that her vision of medieval cities underwent a shift. It began more or less by accident, when she was a graduate student and writing her dissertation on Dutch ceramics such as cooking pots and water jugs. In searching for the best-preserved artifacts, she found that city dwellers would often discard their old kitchenware in the household cesspit—the underground privy located in the backyard of a private home—where it would be mixed in with the family’s communal muck. She spent many hours studying the artifacts dredged up from cesspits. “The boggy environment,” she says, “provided the perfect conditions for preservation.” This allowed her to study centuries-old ceramics that looked like they had

been made the day before.

Over the years, she studied dozens of cesspits in Leiden and dozens more in surrounding cities such as Haarlem. She learned that in the fourteenth century, when regular plots for house construction were first established, cesspits were introduced to these cities in large numbers. In fact, in Dutch urban excavations, archaeologists find cesspits in nearly every plot. As she spent more time examining these sunken brick pits and documenting their contents, she became less interested in the ceramics they contained and more interested in how people of the Middle Ages thought about the cesspits, how they fit into the daily life of the city. She saw that cesspits and other sanitary infrastructure opened an unexpected window into how cities governed themselves.

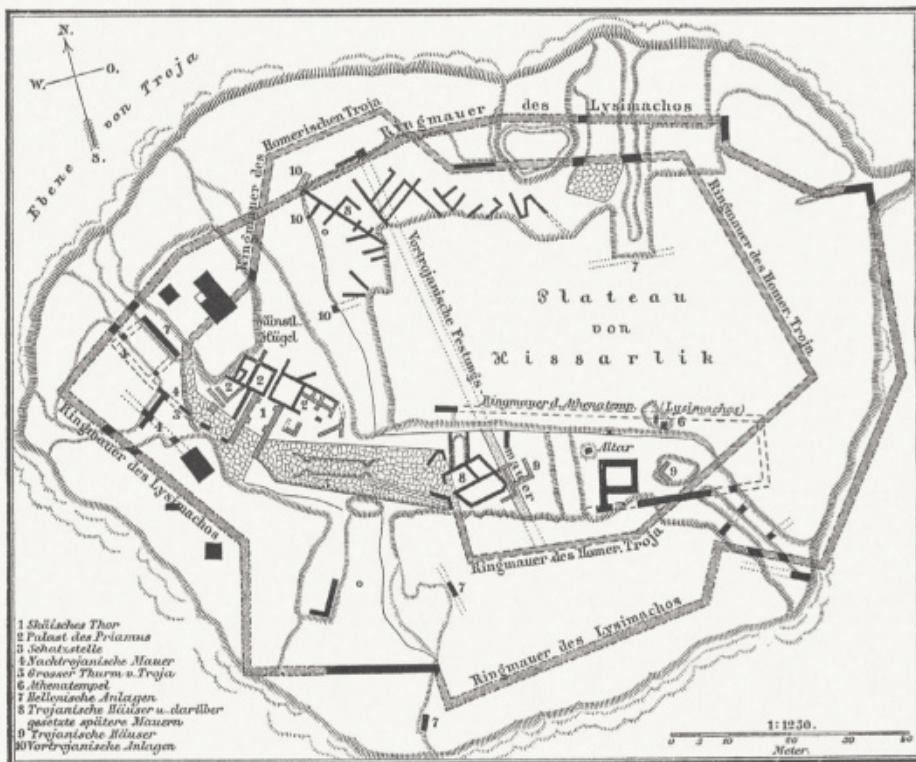
Not far from the Castle of Leiden, a rounded stone structure erected in the eleventh century, van Oosten locks up her bike and heads into a stately brick building that holds the city’s archives. In a hushed room, surrounded by scholars cloistered in study carrels, she lays out a series of pamphlets on a table, each of them centuries old, yellowed and brittle at the edges. They bear such names as “Inspection of the Ordinances on the Subject of Privies” and “Rules and Orders on Privy-Cleaners and Nightworkers.” By examining documents such as these and amassing a large database of excavated cesspits—104 from Leiden alone—van Oosten has been able to reconstruct the intricacies of waste management in vivid detail.

In the archives for an almshouse in Leiden called Sint Agnietenhof, she discovered 34 written permits, each of which describes the cleaning out of a private cesspit by a team of nightmen. The 400-year-old paper trail reveals a

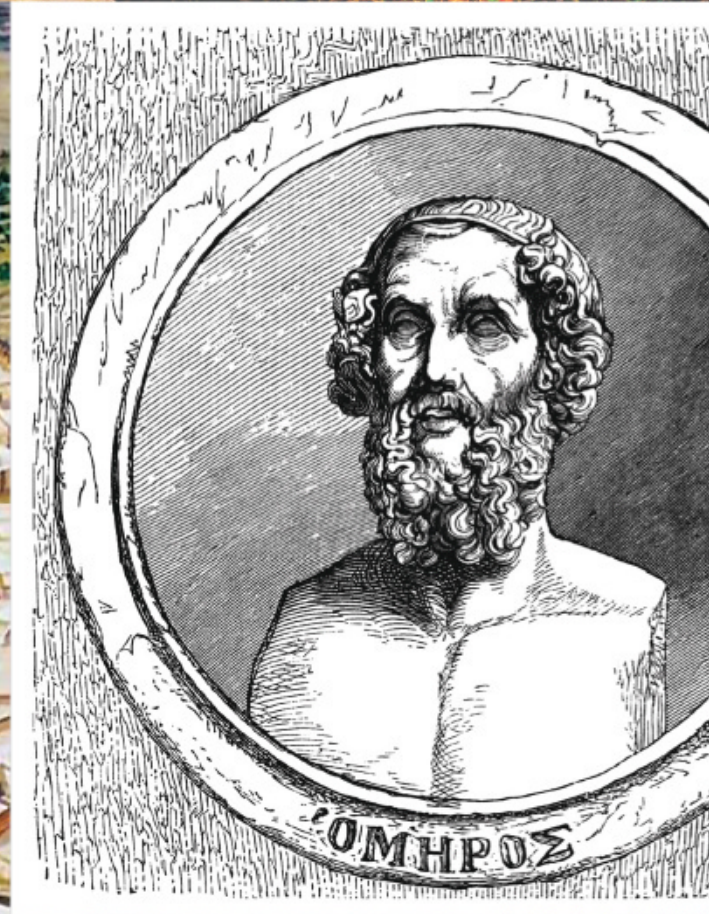


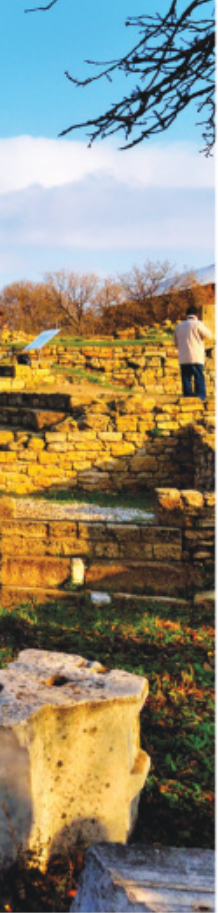
Cartographer Willem Blaeu made this 1649 map of Leiden during a period of urban expansion. The map illustrates how the walled medieval city was laid out around an extensive network of canals.

(continued on page 60)



Plan von Hissarlik (Troy).



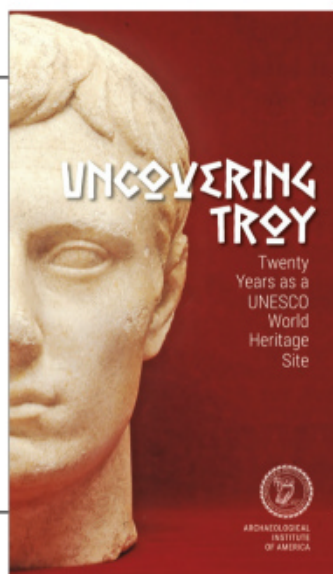


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This year marks the 20th anniversary of the ancient city of Troy's listing as a UNESCO World Heritage Site. Located in the Çanakkale province in Turkey, Troy is the famous site of the Trojan War as first described in Homer's *Iliad*. Over the centuries since its writing, the epic's larger-than-life characters—Achilles, Hector, Paris, Helen, Odysseus, Agamemnon, and others—have become part of many cultures.

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The AIA thanks Richard C. MacDonald for his generous support of the Year of Troy Project.

LETTER FROM LEIDEN

(continued from page 57)

fastidious process, each step of which was administered with precision. On September 20, 1603, she reads, in the backyard of a small house on the Rapenburg Canal in the center of the city, a nightman named Baernt Robberechtsz removed 95 tubs of waste from the cesspit of an aging widow by the name of Sara de Haen. According

sloshing contents back to the barge. Robberechtsz and his crew followed a path through the streets and alleys so exact that their salary was calculated according to how many steps they took. Finally, the crew entered the barge by way of a gangplank and by the light of an oil lantern in order to prevent any spillage in the river. And they did so quietly—if the nightmen were loud, drunk, or sloppy with the

Europe hold documents that reveal long-ignored systems of public health and hygiene. In cities throughout the Netherlands, going back as far as the thirteenth century, so-called mud officials patrolled the streets, doling out fines to citizens who disposed of their waste inappropriately. Other cities benefited from the services of “waste citizens,” who were enlisted to clean specific places in the city in



This brick cesspit (left) in the Dutch city of Haarlem and a sewer line (right) found in nearby Leiden demonstrate the two cities' contrasting approaches to waste management in the early modern period.

to city regulations, Robberechtsz and his team would have guided their barge into the city after 10 p.m., so as not to offend the sensibilities of the citizenry. Upon mooring at the bank of a canal, the nightmen proceeded to the backyard of Sara de Haen's home. The “hole-man” climbed down into the privy and scooped out waste—known as “night soil”—which two men on the surface transferred to a wooden tub or barrel. The “tub-men” then undertook the task of carrying the vessel and its

night soil, they could be prosecuted. Records show that unscrupulous nightmen in Leiden were punished on at least two occasions. Upon completing the job, before they could be paid, their supervisor checked the cesspit to make sure it had been properly emptied. Even centuries later, it is clear that such punctilious lawmaking and record keeping were not the work of a society ignorant of decency, cleanliness, and order.

As it turns out, archives all over

exchange for citizenship. The Belgian city of Antwerp employed men who monitored the city's freshwater supply, while a brigade of “dung carriers” (*moosmeiers*) in Bruges removed waste from cesspits to beyond the boundaries of the city. London was voided of its waste each night by so-called gong farmers.

The city of Ghent—one of the larger urban centers of the late

(continued on page 62)

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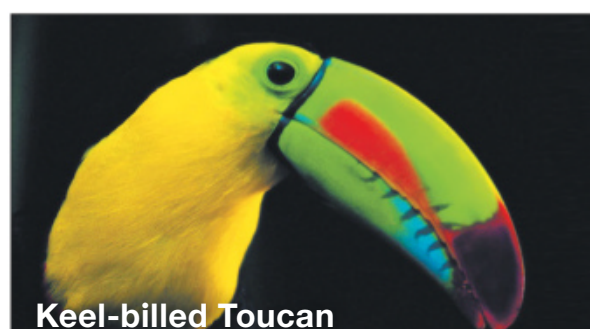
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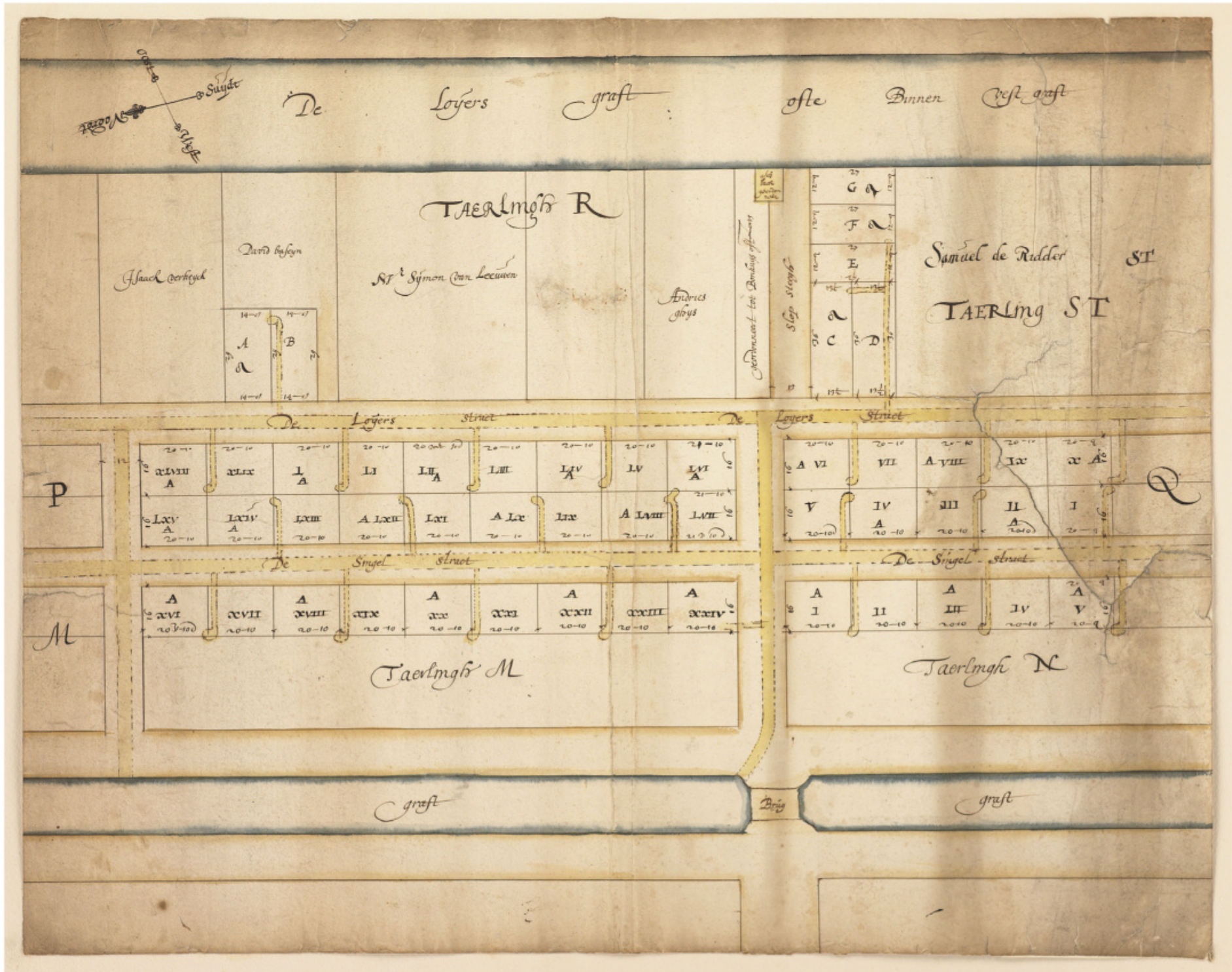
LETTER FROM LEIDEN

(continued from page 60)

medieval period, with a population of 40,000 by the seventeenth century—employed an especially versatile sanitary official known as the “King of Dirt.” As decreed by the city, the King of Dirt, along with a group of underlings known as the “King’s Children,” would patrol the city, punishing citizens for unsanitary behavior. City logs show that one Janne Lanenman held the office of King of Dirt between 1339 and 1348. Clad in a striped yellow tunic—the position’s standard

uniform—he and his minions were responsible for chasing vagrant pigs out of the street and doling out stiff fines to their owners, ensuring that butchers correctly disposed of carcasses, hunting down the source of wayward and noxious aromas, and shooing prostitutes from the city square after sundown. University of Amsterdam historian Janna Coomans has studied the position of the King of Dirt and says that the office demonstrates “a sense of civic responsibility. It shows that there were systems in place to clean waste, that it was not chaos.”

As evening approaches, van Oosten emerges from the archives, unlocks her bike and begins walking along a canal bank toward the city center. Baskets attached to a row of iron streetlamps spill over with bright red geraniums. She peers down at a cluster of lily pads bobbing in the water of the canal at her feet. Today, the canals of Leiden are clean, models of the modern Dutch commitment to water quality, but at the end of the medieval period, they turned toxic. The sewer pipe van Oosten saw



This 1663 plan of Leiden’s sewage system was drawn by land surveyor Johannes Dou. It shows how each individual plot was connected by a short sewer line to the main sewers running under the streets.

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LETTER FROM LEIDEN



This ca. 1900 photograph shows one of Leiden's canals. When the city began using a sewer system in the 17th century, sewer lines deposited waste directly into such waterways.

cracked open at the Meelfabriek site helps explain how this happened. The excavation there exposes a moment in the history of Leiden when the city shifted away from the cesspit system. In the early seventeenth century, at the behest of the dominant, expansion-minded textile barons, officials began to install brick sewer infrastructure that was much cheaper to maintain than cesspits. Archaeologists have unearthed more than two dozen of these brick sewer lines in Leiden's city center. They ran from privies in the backyards of houses, down streets, and emptied into canals. The communal sludge that had been so efficiently managed by nightmen was now flowing directly into the city's stagnant canals. Though this period coincides with the prosperous era known as the "Dutch Golden Age," public health in Leiden fell off steeply. As city dwellers drank beer brewed with contaminated water, an epidemic broke out: Between June and December of 1669, 40,000 people fell ill and 2,000 people died from what was known at the time as "the fevers," but was probably cholera, or the "blue death."

It also gave rise to an epic stench. One Leiden resident, Adam Thomasz Verduyn, wrote in 1670 that the installation of sewers had turned his city into a "stinkhole" that reeked like a "common privy." Van Oosten refers to this as the "Great Dutch Stink." The Dutch Golden Age, then, not the medieval era, was when Leiden transformed into the foul city of Victorian imagination.

The pattern is thrown into even sharper relief, van Oosten says, when she compares Leiden to the city of Haarlem, where the primary industry was breweries, whose owners were deeply concerned with water quality. Because of this, officials in Haarlem did not fill in their cesspits and replace them with sewer infrastructure. Neither epidemic nor great stink occurred in Haarlem, where the era of cesspits lasted until the nineteenth century.

Van Oosten—along with Coomans and other colleagues—now participates in a multidisciplinary research initiative called Premodern

Healthscaping. The project aims to reveal the sophistication of public health and sanitation in late medieval cities. They strive to counter the "smear campaign" carried out by the Victorians on medieval urban life. (The project motto: "Less mud-slinging and more facts.") Contributors to the effort have archaeologically documented the ubiquity of public baths in late medieval cities, where people of every class came to

wash themselves on a regular basis. They have shown that soap-making guilds were part of a booming economy, that late medieval urbanites were lovers of perfume, and that they valued clean teeth. Literary scholars have shown that medieval poets championed the joys of bathing and that knighting ceremonies culminated in scented baths.

None of this is to suggest that any late medieval city was necessarily a paragon of salubrity, certainly not by today's standards. A stroll through the center of medieval Leiden, or any other city at the time, would deliver an olfactory experience powerful enough to buckle the knees of most modern people. But life in these cities transcended hygienic unpleasantness. "It's not that there wasn't disease and dirt," says van Oosten. "But cities weren't disorganized, they weren't urban graveyards. People weren't indifferent. They cared about their environment." ■

Will Hunt is author of the forthcoming *Underground: A Human History of the Worlds Beneath Our Feet*.



2019 AIA-SCS JOINT ANNUAL MEETING IN SAN DIEGO, CALIFORNIA



Marriott Marquis San Diego Marina Hotel

The 120th Joint Annual Meeting of the Archaeological Institute of America and the Society for Classical Studies will take place January 3–6, 2019, at the Marriott Marquis San Diego Marina Hotel. Nearly 2,500 attendees, including professionals in the field, students, and archaeology enthusiasts, will be at the meeting. The latest information, including the program and registration and hotel/travel details, is available online at archaeological.org/annualmeeting.

123RD SEASON OF THE AIA LECTURE PROGRAM IN FULL SWING

The 123rd season of the AIA Lecture Program, which began in August 2018, will run through May 2019. Approximately 20,000 people attend AIA lectures each year, making it one of the Institute's largest outreach efforts.

Still to come in the 2018–2019 season is a tour from January 24 to February 28 by AIA Kress Lecturer, Troels Myrup Kristensen, associate professor of classical art and archaeology in the Department of Culture and Society, Aarhus University. Kristensen's lecture *Connecting the Dots: New Perspectives on Mobility and Gathering in Ancient Mediterranean Sanctuaries* discusses the results of a recently completed five-year research project on ancient Mediterranean pilgrimages.

ARCHAEOCON 2019 IN SAN DIEGO



Join us to celebrate the AIA's 140th anniversary at ArchaeoCon in San Diego on Saturday, January 5, at the Marriott Marquis San Diego Marina Hotel. ArchaeoCon is a public event for people of all ages that will feature entertaining and educational programs, workshops, and demonstrations that celebrate archaeology and the AIA. AIA Trustees Sarah Parcak, 2016 TED Prize winner

and founder of GlobalXplorer®, and Josh Gates, host of *Expedition Unknown*, will headline the festivities. Event details are available at archaeological.org/annualmeeting.

BECOME AN AIA MEMBER TODAY!

AIA programs and activities shared in "Dispatches from the AIA" are made possible through membership dues and gifts from generous donors. The AIA uses these resources to continue its mission of supporting archaeological research, preserving sites around the world, promoting outreach, and making the world of archaeology accessible through its publications and websites. We urge you to join the AIA and support the Institute's efforts to understand, protect, and promote our cultural heritage. Visit archaeological.org/join.



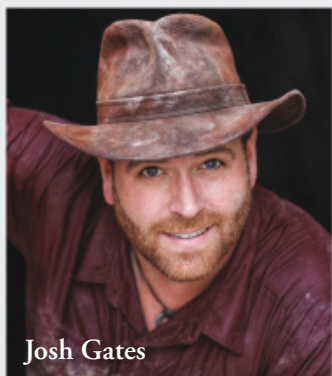
DISPATCHES

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Sarah Parcak



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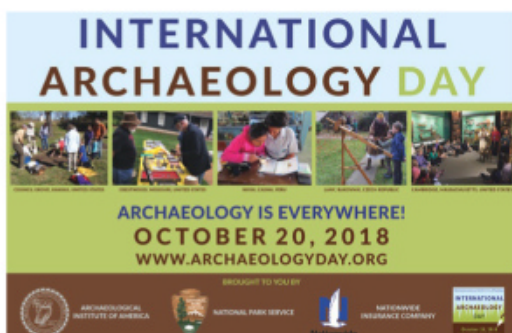
The AIA is hosting a very special event in Los Angeles on Saturday, February 2, 2019, at the University of Southern California's Bovard Auditorium. Join renowned archaeologist Sarah Parcak and explorer Josh Gates from the Discovery Channel as they share entertaining stories from the field and from their television experiences. There will be time for audience members to ask questions and an opportunity for some attendees to meet the presenters.

Sarah Parcak, National Geographic Society Archaeology Fellow, Fellow of the Society of Antiquaries, and winner of the 2016 \$1 million TED Prize, serves as the founding director of the Laboratory for Global Observation at the University of

Alabama at Birmingham. Josh Gates is an adventurer and avid explorer. The Discovery Channel's *Expedition Unknown* chronicles Gates' adventures as he sets out on a global journey to find the truth behind iconic unsolved legends.

Visit the AIA website at archaeological.org for tickets and more information about this exciting evening.

INTERNATIONAL ARCHAEOLOGY DAY CELEBRATIONS HELD AROUND THE WORLD

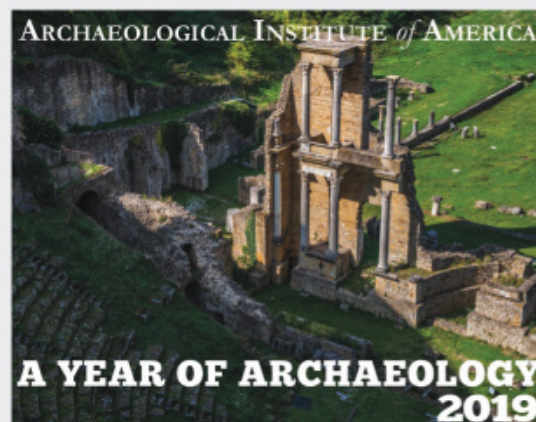


The eighth International Archaeology Day (IAD) was observed around the world on Saturday, October 20, 2018. This annual celebration of archaeology, begun by the AIA in 2011, has grown

exponentially over the last eight years. In 2018, more than 1,000 events were held by hundreds of Collaborating Organizations in over two dozen countries. Within the United States, 46 states held IAD events and close to 80 AIA Societies hosted activities in their communities. We estimate that more than 200,000 people attended these events.

IAD is held annually on the third Saturday of October. Though the majority of events take place on that day, activities continue throughout the month. IAD 2019 will take place on October 19. Sign up today to become a Collaborating Organization and plan a public event that showcases archaeology. Find out more at archaeologyday.org.

"A YEAR OF ARCHAEOLOGY": AIA'S 2019 CALENDAR AVAILABLE FOR PURCHASE



You can still buy the AIA's 2019 calendar, "A Year of Archaeology," featuring archaeological images from the AIA's Annual Photo Contest. Proceeds support the AIA's Site Preservation Program, which has awarded grants to help preserve and protect 29 sites on five continents. Buy a calendar today for yourself or as a gift for friends and family to support the protection of archaeological sites for years to come at archaeological.org/calendar.

CAREER SERVICES

The AIA is pleased to announce that we recently rejoined the Society for Classical Studies' Placement Service. If you are an AIA member, you now have access to all the benefits of the Placement Service at no charge, including scheduling job interviews at the annual meeting, uploading to the CV/Resume Book, and all the other benefits that come with being a member. For complete details, go to archaeological.org/careers.

AIA SPRING GRANTS AND AWARDS

Each year the AIA makes available numerous grants, fellowships, scholarships, and awards to support and recognize the efforts of scholars and students. To be eligible for AIA grants and fellowships, applicants must have been members of the AIA for at least two consecutive years (one year for students) by the application deadline. To learn more about AIA fellowships and grants, please visit archaeological.org/grants.



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Departure Dates (ays)

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February 23 (17 days)
March 15 (14 days)
August 31 (15 days)
October 17 (11 days)
October 19 (16 days)

AIA Lecturer

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Stephen Harvey
Trevor Marchand
Ian Tattersall
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July 20 (12 days)

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Iran: The Ancient Land of Persia
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Japan by Sea: Land of the Rising Sun 
The Silk Road: Empires of Central Asia
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Temples & Palaces of Northern India
Vietnam, Cambodia & the Mekong River

April 10 (16 days)
May 4 (13 days)
May 5 (15 days)
May 17 (17 days)
October 5 (19 days)
October 30 (18 days)
December 2 (14 days)

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Dalmatia & Ancient Greece 
Classical Greece & Islands of the Aegean 
Sicily
The Legacy of Ancient Rome

May 6 (14 days)
May 7 (12 days)
May 19 (9 days)
May 30 (11 days)
June 9 (15 days)
June 23 (10 days)
July 13 (11 days)
July 13 (11 days)
September 4 (14 days)
September 18 (13 days)
September 18 (14 days)
September 24 (14 days)
October 2 (11 days)
October 6 (12 days)

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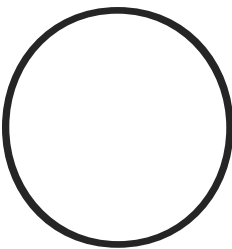
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SAMARKAND, UZBEKISTAN,
seen on the *Silk Road* tour with
Aleksandr Naymark in May 2019

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ften something handed down from generation to generation becomes your most treasured possession, be it your grandmother’s wedding ring, your grandfather’s WWII dog tags, or your mother’s silver. This ivory plaque was almost certainly such an heirloom. While the building in which it was discovered dates to the eighth century B.C., the plaque itself is at least 200 years older. The artifact was carved in a popular Near Eastern style called the Flame and Frond School, characterized by flame-like patterning on animals’ haunches—in this case two gamboling goats—and the presence of a tree in the center. This highly decorative motif is found on many ivory artifacts, most of which likely once decorated perishable items such as wooden furniture and boxes.

The plaque was discovered at Arslantepe, which was a fortified citadel enclosed by a massive defensive wall and which served as the capital of the Neo-Hittite kingdom of Melid at the beginning of the first millennium B.C. The Neo-Hittites lived in northern Syria and southern Anatolia from the end of the second millennium to around the eighth century B.C. The plaque is among the very few luxury items to have been found at Arslantepe. “This was a valuable imported object likely made in northern Syria that reached Arslantepe by a network of trade and communications between the surrounding kingdoms and empires,” says archaeologist Federico Manuelli of the Free University of Berlin. “The Flame and Frond motif suggests intriguing cross-cultural relationships with the Levant and Mesopotamian worlds, and the plaque might have been stored as a precious artifact with great symbolic and ideological meaning.”

WHAT IS IT
Plaque
CULTURE
Neo-Hittite
DATE
10th century B.C.
MATERIAL
Elephant ivory
FOUND
Arslantepe, southeastern Turkey
DIMENSIONS
3.1 inches long, 1.6 inches high, 0.19 inches thick





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